WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

A Scranton Gillette Publication

FEBRUARY 1957

Water Distribution Systems: Their Operation & Maintenance
In which roll-on-joints are the most recent development in cast-iron pipe.
(Pages 48-75)

Atlanta's Engineered Water System Expansion Program
(Pages 42-47)

Sewage & Industrial Wastes in 1956—A Review
(Pages 49-61)

Superior Performance

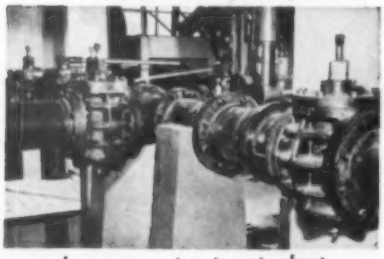
by all acf Lubricated Plug Valves

THIS TEFLON GASKET PREVENTS HEAD LEAKAGE— REDUCES TURNING TORQUE

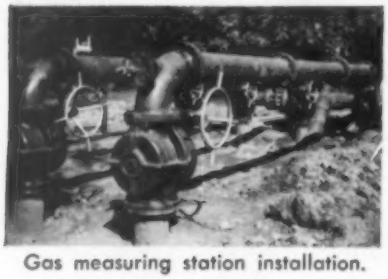
* Gasket Characteristics

. . . Self lubricating
. . . Can't bind
. . . Unique shape maintains lubricant release
. . . Pressure tight.

On circulating water pumps in petroleum industry.



In sewage treatment plant.



Gas measuring station installation.

This Teflon* Gasket is another example why acf lubricated plug valves are your best buy in round or rectangular port valves.

It not only gives greater protection against head leakage, greatly reduces turning torque, and operates in temperature to 450°F, but it also prolongs service life . . . and that means a substantial saving in valve maintenance costs.

Many years of field testing, plus years of industry service, have proved the importance of this feature in acf valve performance. See your acf Representative and learn why it pays to specify acf valves.

* DUPONT TRADE NAME

5602

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DIVISION OF acf INDUSTRIES INCORPORATED

PLANT: MISSOURI CITY, TEXAS • MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURING

W-K-M THROUGH-CONDUIT GATE VALVES

acf LUBRICATED PLUG VALVES

KEY RETURN BENDS AND FITTINGS

Combined MILITARY-CIVIC CENTER Adds Permanent Health Insurance

During World War II, the Air Force built a flight base near the quiet little Georgia town of Warner Robins. Almost overnight, it became a bustling city . . . and it has continued to expand ever since. By 1950, its population had reached nearly 8,000. Today, it is estimated at 17,000, and Warner Robins is also the civic center for another 16,000 living on the adjacent military reservation. The city has settled down to steady, long-term growth.

Warner Robins is providing "health insurance" for its future with *permanent* Vitrified Clay Pipe. More than 96,000 additional feet of Clay Pipe in diameters up to 30 inches was recently installed, together with a treatment plant that can be expanded to serve a community of 30,000. Warner Robins, following the lead of many growing cities, is set for the future—with the *only* sewer pipe that *never wears out.*

Mayor: W. T. Giles.
City Engineer: C. M. Franklin.
Architects and Engineers: Vinson & Company.
Chief Engineer: R. M. Breen.
Resident Engineer: W. R. Peck.
Contractor and General Supt.: Howard T. Barry.

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Vitrified

CLAY PIPE
CLAY PIPE NEVER WEARS OUT!

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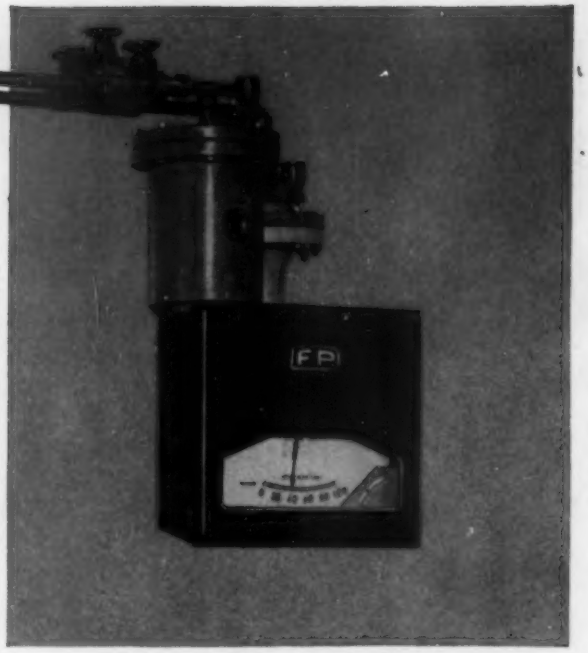

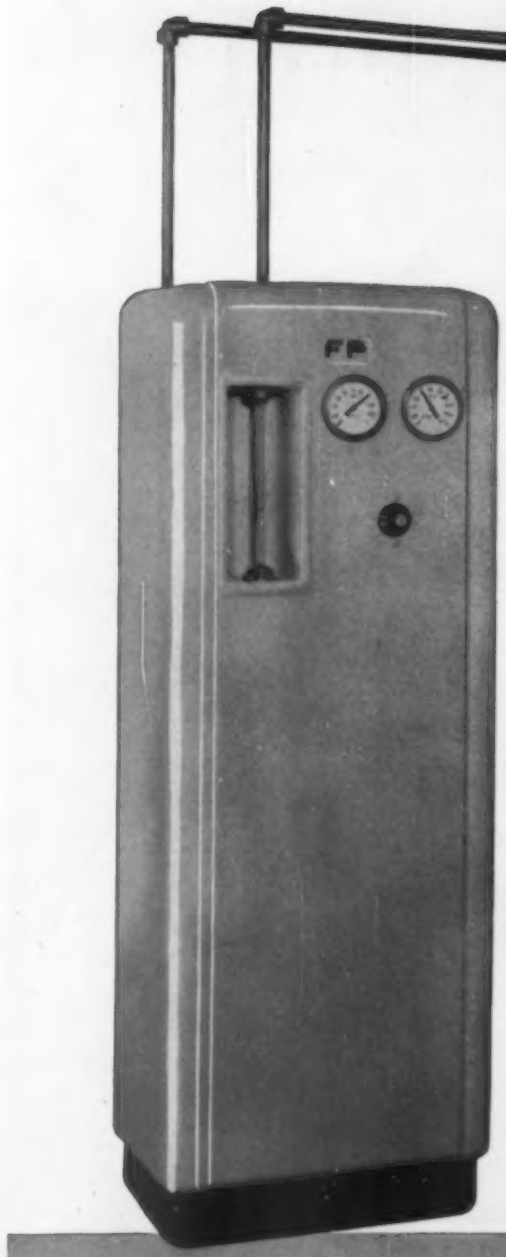

Continuous visual record assures efficient use of Chlorine

EFFICIENT USE OF CHLORINE puts money in your pockets. Comparison of chlorine and main line flow records provides a continuous safeguard against wasted chlorine or insufficient dosage by continuously monitoring the accuracy of the system.

This recording system is readily adaptable to most chlorinators of all manufacturers.

A simple screwdriver adjustment permits field synchronization of the flow recorder with the interchangeable capacity of the chlorinator. Indicators, totalizers, transmitters and high-low alarms are available for use in this F&P Chlorine Flow Recording System. These functions may be located remotely by the use of F&P pneumatic or electric transmission systems.

Every part is completely corrosion resistant. Magnetic coupling eliminates the need for trouble-making pressure tight bearings.

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FP FISCHER & PORTER CO. Hatboro, Pa.

COMPLETE PROCESS INSTRUMENTATION

LA 1151

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

Vol. 104 No. 2

FEBRUARY 1957

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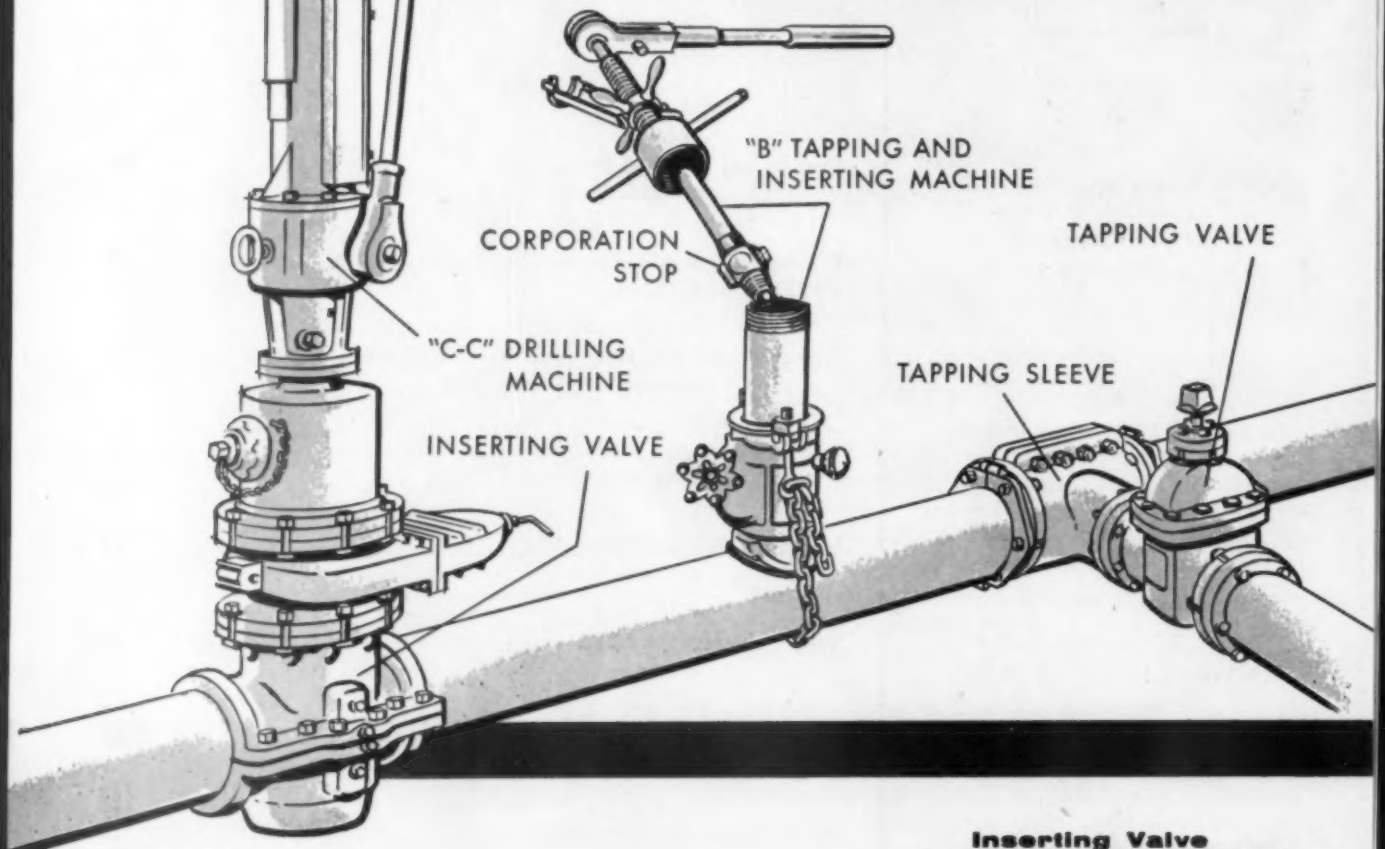

it's Mueller... all along the line...

Inserting Valve
Provides additional control at vital points in existing lines. Installed, under pressure, without interrupting service or losing water. Operates like a regular Mueller Gate Valve, with easy operation and positive shut-off. Parts are interchangeable with Mueller Gate Valves. For 4", 6" or 8" lines.

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Hand operated. Makes 2" to 12" cuts in any size main, dry or under pressure to 500 p.s.i. 25" boring bar travel. Automatic feed for drilling; hand feed for rapid advance. Power operated C-1 machine with air or gasoline engine power units available. Feed indicator standard on both C-C and C-1 machines.

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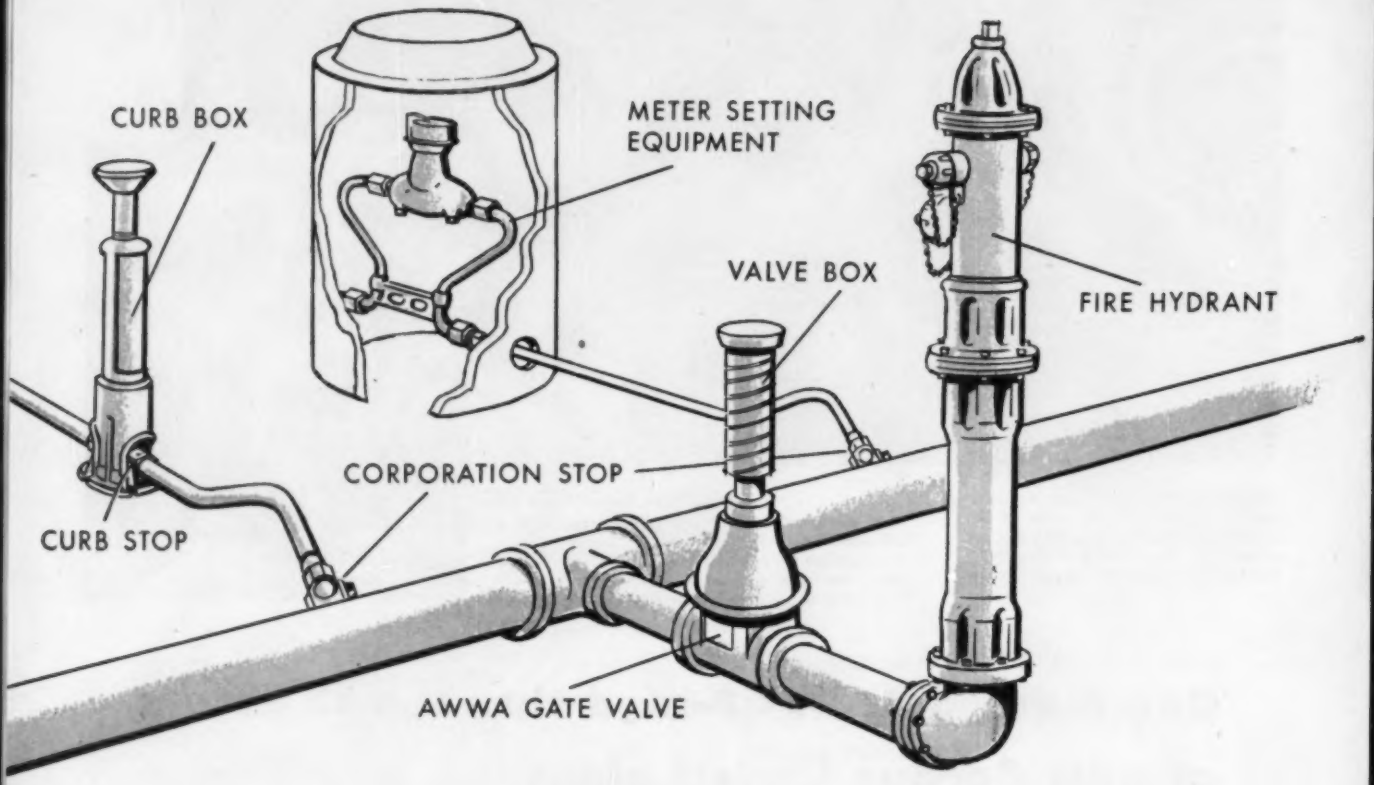
for trouble-free service!



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Since 1857

Corporation Stop
Can be installed in lines under pressure. Keys and bodies are of finest water works bronze, precision machined, individually ground and lapped. Accurately machined threads assure water tight connections. Inspected and tested under pressure. Sizes ½" through 2" with a variety of inlets and outlets.

Tapping Sleeve
Used with a tapping valve – connects lateral or branch main under pressure, without shutdown or loss of water. Heavy construction adds strength and rigidity at the connection. Nominal size fits all classes of cast iron pipe by using either of two sets of gaskets. Sizes 3" through 48".

Tapping Valve
Oversize waterway allows full-size cut and maximum flow. Exclusive four-point disc wedging mechanism produces tight shut-off and trouble-free operation. With "O" ring stem seal or conventional packing. Sizes 2" through 16". Hub or mechanical joint type ends.

Valve Box
Two or three piece – sliding or screw types for valves 3" and larger. 5¼" shaft. Valve box adapters and extension pieces for both types. Also available, 4¼" shaft, roadway screw type for 3" and smaller valves.

AWWA Gate Valves
Exclusive four-point wedging mechanism distributes seating pressure equally to four points near outer edge of disc. Shut-offs are fast, easy, positive. Permanently lubricated stem thrust collar for reduced maintenance on "O" ring type valves. Stem seals are "O" ring or conventional packing. Rising or non-rising stem.

Curb Stop
Ground key is individually lapped, precision fitted into body of cast water works bronze. Steep key taper gives ease of operation, long life, positive pressure tightness. Cap and tee on inverted key type has accurate built-in check. Sizes ½" through 2". Inverted key or solid head type.

Curb Box
Telescoping section prevents damage to box, stop or service line. Phosphor bronze spring holds upper section in place while back-filling. Lid is bronze-bushed for easy removal of access plug. Rigid support given by arch-type base. Coated with protective tar-base enamel. For stops ½" through 2".

Fire Hydrant
Dry top design with "O" ring stem seals keeps moisture away from operating threads. Lubricating reservoir gives positive lubrication each time hydrant is operated. Safety flange and stem coupling limits traffic damage to small inexpensive parts - hydrant barrel and stem are re-used. Compression-type main valve. Double drain valves force flushed each time hydrant is operated.

Meter Setting Equipment
Copper meter yoke with multi-purpose connectors... relocation yokes...iron meter yokes...plain or lock-wing angle stops...meter couplings...each with a variety of inlets and outlets.

Filter house control panel puts complete control of this 48-mgd plant in the hands of one man. The plant was designed by Reagan and McCaughan, Consulting Engineers, Corpus Christi.

In the pipe gallery, these Honeywell Mercuryless Differential Converter pneumatic transmitters measure loss of head and filter effluent flow. Remotely set Honeywell diaphragm actuators position butterfly valves to hold desired filtering rate.

One man controls 48-mgd through 12 filters at new Corpus Christi plant

. . . using Honeywell *Filtermatic** System

CENTRALIZED instrumentation, incorporating a Honeywell *Filtermatic* control system, increases efficiency and cuts supervisory work load at the new O. N. Stevens Water Filtration Plant at Corpus Christi, Texas. At his instrument panel, a single operator can see everything he needs to know about the functioning of 12 filters that treat 48 million gallons of water daily. All filtering controls are right at his finger tips. During backwashing, valves are positioned and flow rates adjusted from individual filter consoles. There's never any need to go down to pipe galleries to operate this plant.

Tel-O-Set miniature indicators which show rate of flow through each filter, permit individual adjustments of filtering rate set points, and provide continuous indication of filtering rate and desired filtering rate. In addition, a 12-point *ElectroniK* instrument records all these flow values on a single wide chart. Loss of head for each filter, indicated by individual dial gages, is recorded by another 12-point *ElectroniK* instrument. There are also recorders for clearwell level, wash water tank level, plant effluent main pressure, plant effluent flow, and wash water flow.

Honeywell service on this installation covered not only application engineering of the control system, but also complete fabrication, piping and wiring of panels in Honeywell's Houston service shop. This complete service lowers construction and installation costs, and assures adherence to construction and startup schedules.

A Honeywell field engineer will be glad to talk over your filter plant control, with you and your consulting engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Phila. 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

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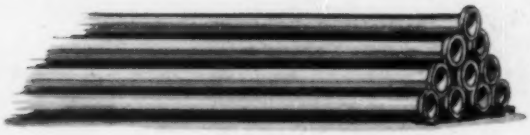
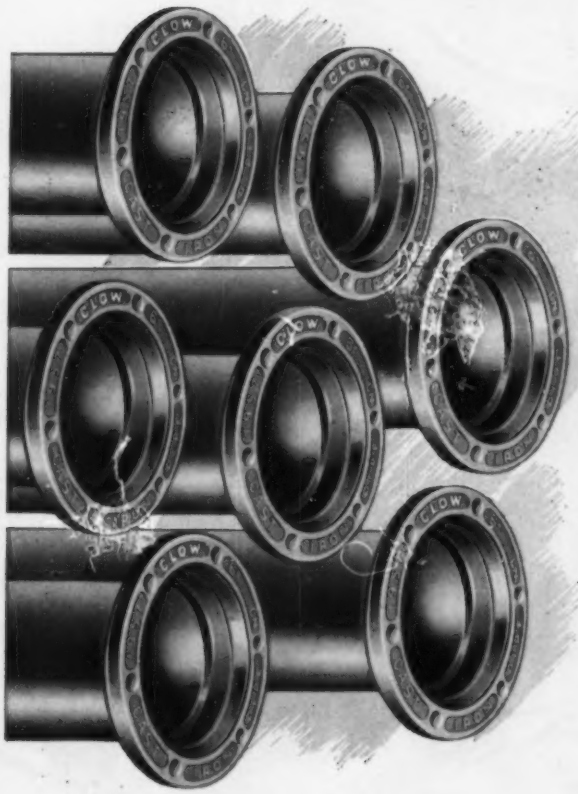
take advantage of the plus factors when you specify UNDERGROUND WATER PIPE





Experienced men who specify and install underground water pipe take advantage of the plus factors when they specify cast iron pipe.

Take the pressure plus factor. Minimum wall thickness Clow cast iron pipe (ASA A21.6 Class 22) is rated for at least 250 psi working pressure in diameters 10″ and smaller.

What does this mean? It means that cast iron pipe is rated safely above the minimum pressure requirements for municipal water service, and can be specified to the full ASA rated working pressure. This is because of the inherent strength of cast iron pipe . . . beam strength . . . compressive strength . . . bursting strength . . . all scientifically calculated with ample factor of safety on the basis of sound engineering practice and the result of actual service records.

To get the best advantage of the plus factors for your system, invite a Clow man in to discuss your requirements when pipe first enters your plans.

JAMES B. CLOW & SONS, Inc.

201-299 N. Talman Avenue • Chicago 80, Illinois

Subsidiaries: Eddy Valve Company, Waterford, New York • Iowa Valve Company, Oskaloosa, Iowa

SINCE 1878

a cinch to

Tyton Joint pipe is *quite* as easy to install as our hillbilly friend indicates. Only one accessory needed ... a specially designed rubber gasket that fits into the bell of the receiving pipe. A push or two and the connecting pipe compresses the gasket ... seals the joint bottle-tight and permanently.

No bell holes. No waiting for weather. "Tyton" can be laid in rain or wet trench. It's so simple, in fact, even an inexperienced crew quickly becomes expert.

U.S. cast iron PIPE FOR WATER, SEWERAGE AND

install!

You'll be hearing more about this ingenious new Tyton Joint. Why not get the facts firsthand...and now?

Write or call. We'll be glad to give them to you.

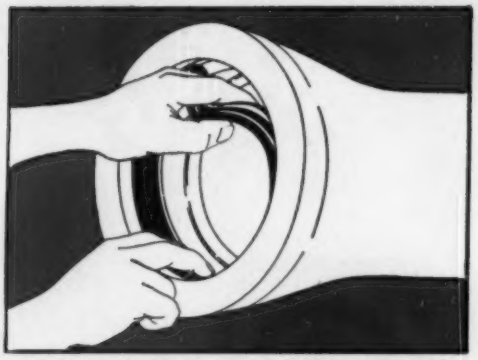
U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE

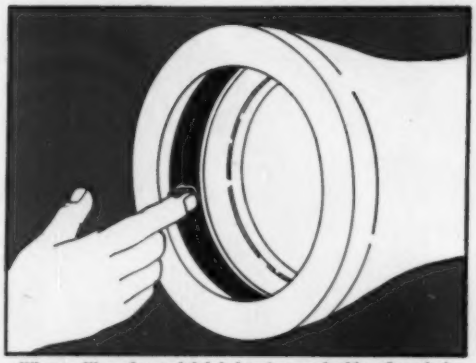
INDUSTRIAL SERVICE CAST IRON

U. S. TYTON JOINT

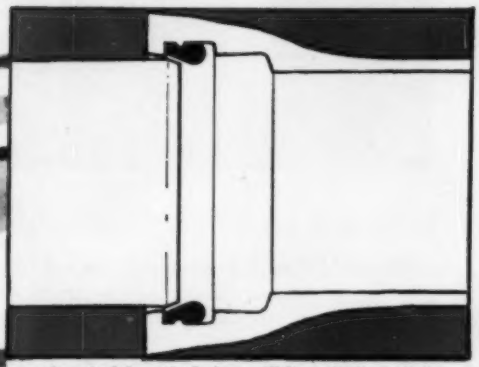
ONLY FOUR SIMPLE ACTIONS



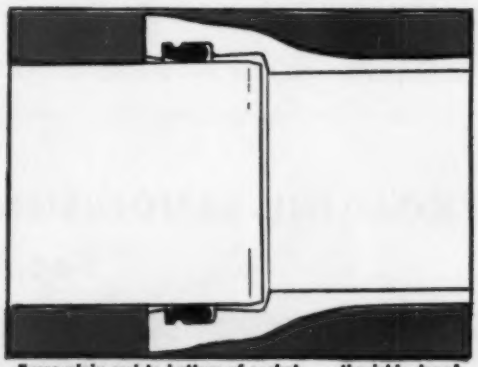
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket



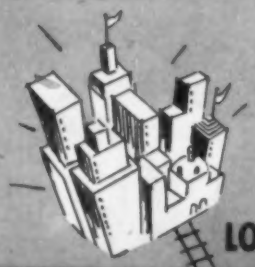
Insert plain end of pipe until it contacts gasket



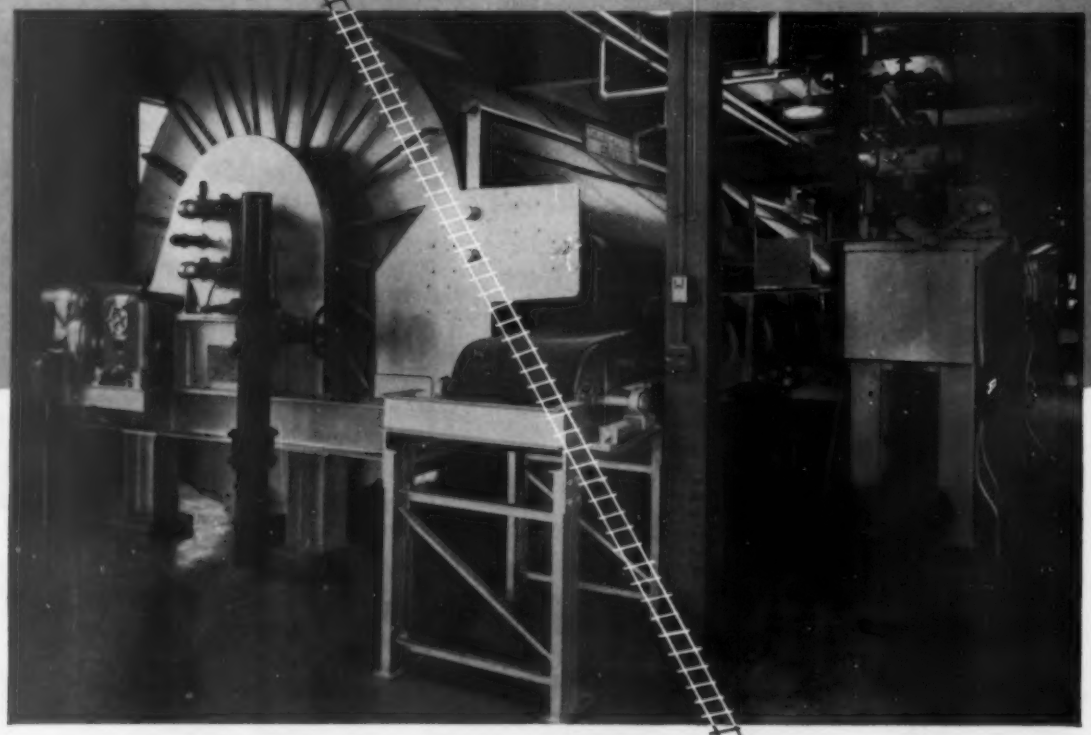
Force plain end to bottom of socket . . . the job's done!

Louisville & Nashville

now to be served by two "Old Reliables"



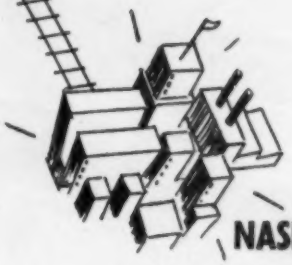
LOUISVILLE



In railroads it's the L & N—in sludge vacuum filters, it's the COILFILTER. Both have earned the nickname "The Old Reliable" through years of faithful and dependable service.

Louisville's new plant will include three 430 sq. ft. COILFILTERS. Metcalf & Eddy, Engineers.

Nashville will have two 300 sq. ft. COILFILTERS. George P. Rice, Consulting Engineer. The Chester Engineers, Consultants.



NASHVILLE

KOMLINE-SANDERSON ENGINEERING CORPORATION

Peapack, New Jersey

MANUFACTURERS OF COILFILTER SLUDGE VACUUM FILTERS

WATER WASTE

Caught Red Handed!

...and a much closer accuracy check provided!

A BIG RED HAND is furnished as standard construction on all Rockwell meter registers. Like the split second hand of a stop watch it sweeps the entire outer circumference of the dial. The slightest movement can be seen.

The big red hand is a tremendous aid when checking or demonstrating leaks in your customers' homes. And with this large, slow moving, center mounted test hand, you can get a much closer reading on the accuracy of new or repaired meters.

By any comparison—accuracy, durability, repair ease or convenience—Rockwell meters measure up to the highest standards. Ask our representative to demonstrate, or write today for latest bulletin.

ROCKWELL MANUFACTURING COMPANY

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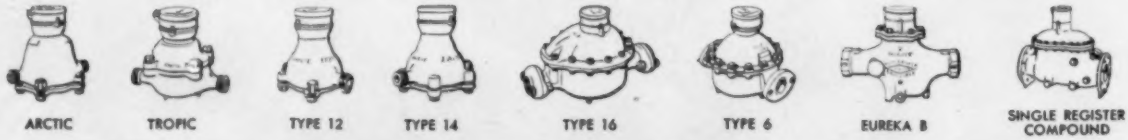
ROCKWELL WATER METERS

A Size and Type For Every Kind of Service



For Columbus' new expansion to 120 mgd....

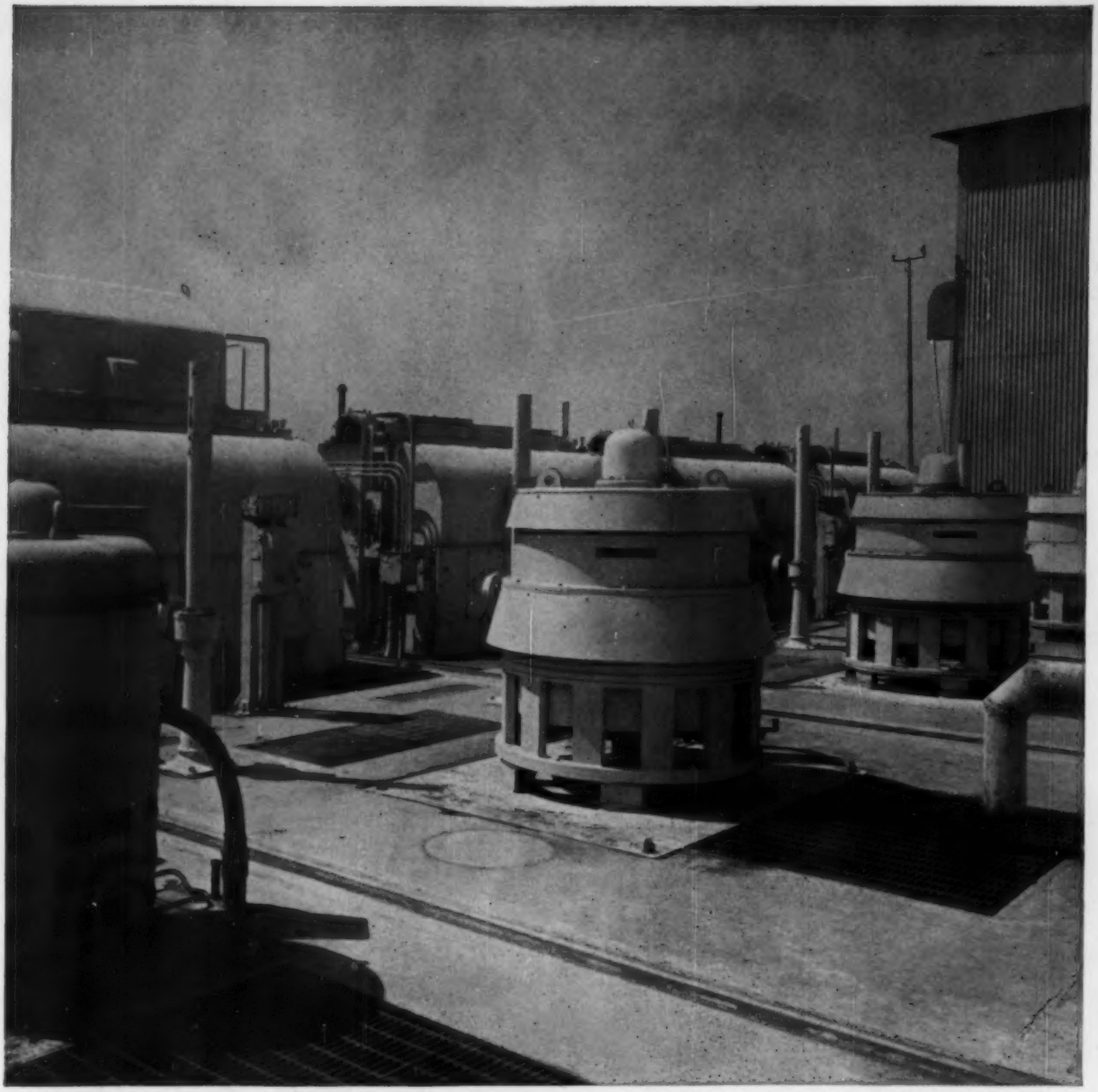
Plant Manager, James H. Blodgett, and Uhlmann Associates, consulting engineers, faced tough problems in doubling the capacity of a previously expanded activated-sludge plant.

To get top plant performance, the complex instrumentation—both old and new—would have to be pulled together. Twenty year old meters would have to be modified, rebuilt, or replaced to work alongside today's improved models, telemetering total influent for the entire expanded plant to *one central control point.*

Here's why Simplex was selected to solve these problems. Simplex redesigned and will rebuild the *old* venturi tube receivers to perform dependably and accurately alongside the newest venturi tubes and meters—specially engineered by Simplex to Columbus' exact requirements. From this integrated system of old and new units spread over a big plant area, Simplex Orthoflow® will *electrically* transmit vital influent data to one central control point—instantly, accurately.

Your Plant. We'll gladly help you in expanding your old plant or planning a new one. Write today outlining your problem. Simplex Valve & Meter Company, Dept. WS-2, 7 East Orange Street, Lancaster, Pa.

SIMPLEX®
VALVE AND METER COMPANY



Four Fairbanks-Morse low-lift propeller pumps at Fairless

Delaware Borrow

Every day the Fairless Works takes 230 million gallons of water from the Delaware River, uses it in the production of iron and steel, and after treatment returns it to the river. The "big borrow" is started in a plant pumping station equipped with ten Fairbanks-Morse propeller and turbine pumps in efficiently chosen sizes up to 48 inches.

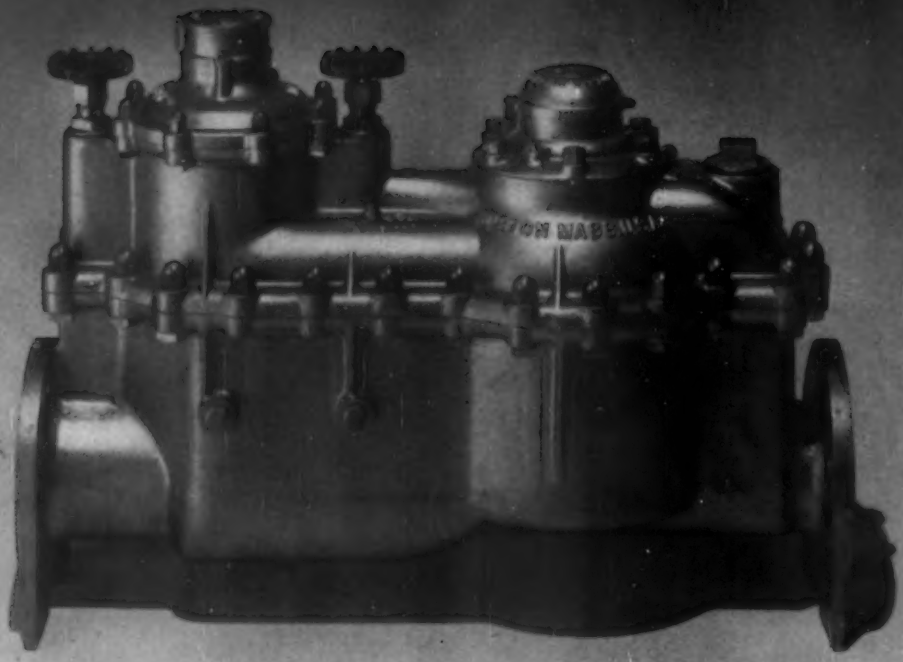
There are pumps in the Fairbanks-Morse line to move any magnitude of industrial water supply at any appropriate pressure, and other pumps to meet ordinary or unusual problems of industrial wastes treatment and disposal. A Fairbanks-Morse hydraulics engineer will be happy to work with your engineers or consultants in specifying the right pump for your specific job. Fairbanks, Morse & Co., Dept. WSW-2, 600 South Michigan Avenue, Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

No substitute can do what the Hersey Compound Meter does.



All bronze case 2" to 6" inclusive

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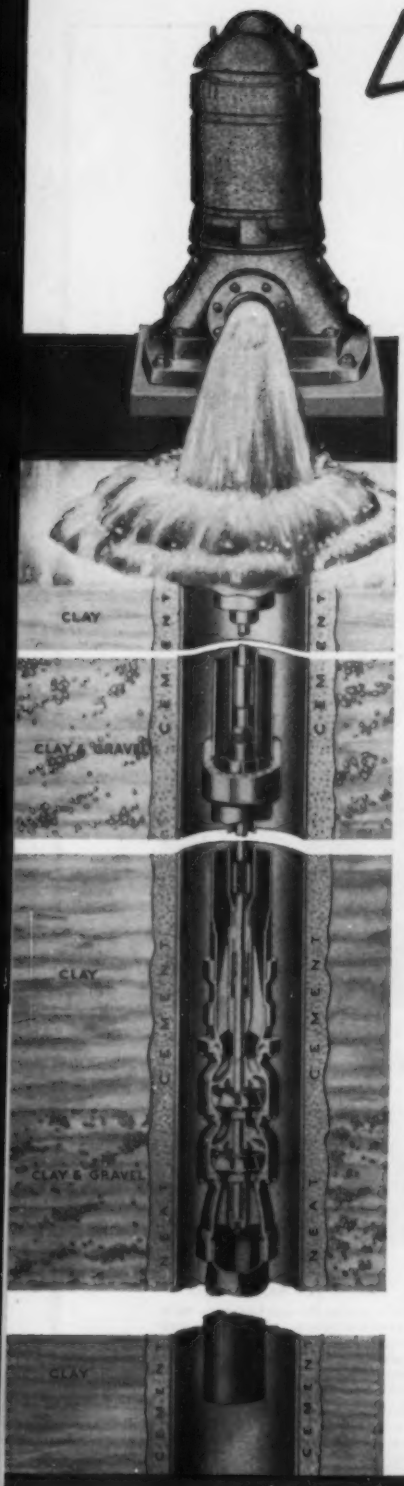
SAN FRANCISCO — LOS ANGELES

Layne knows more about water bearing formations!



On whose say-so? Not on ours—but on the experience of scores of American and foreign firms and municipalities whose very existence and success depend on an adequate supply of water.

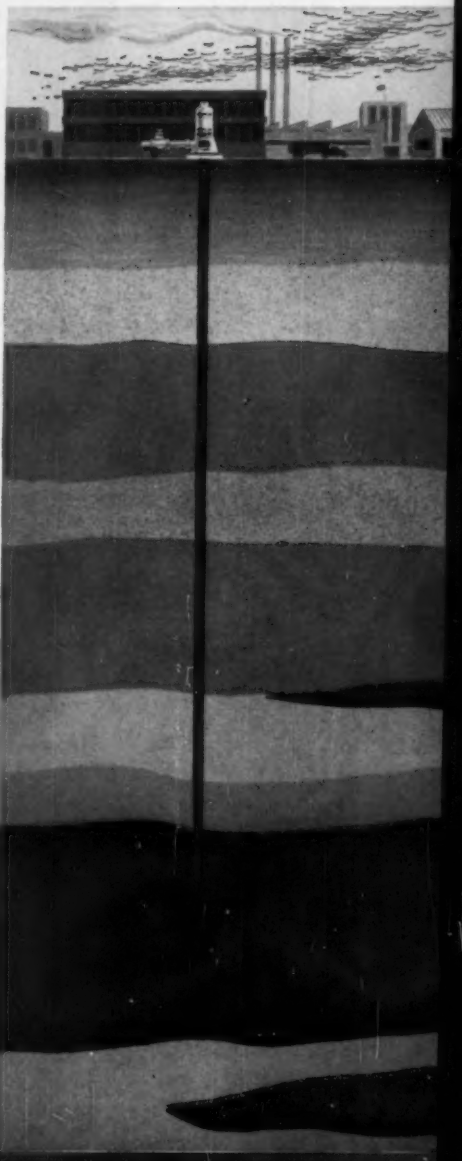
Knowing where the water is — and then tapping the subterranean source is but a part of the vast knowledge the Layne organizations have accumulated in three quarters of a century.

Once the source is determined and the water supply developed, a dependable means for delivering the water must be provided, and that's where the famous Layne pump comes in. For each Layne pump is specifically engineered for the particular job. There is no "stock" Layne pump. Your pump is created for your job —making use of the knowledge of strata, water requirements and usage.

ENGINEERED, DEPENDABLE PERFORMANCE IS WHAT YOU GET WHEN LAYNE DOES THE JOB — COMPLETE FROM WATER LOCATION TO YEAR AFTER YEAR OF TROUBLE-FREE PUMPING.

YOUR NEXT WELL AND PUMP INSTALLATION MAY BE MONTHS OFF. GET TO KNOW THE LAYNE FOLKS IN YOUR AREA. SAVE TIME AND MONEY THROUGH THEIR INTIMATE KNOWLEDGE OF WATER.

Send now for our general services bulletin No. 100.



1882 — 1957
Layne
75 YEARS OF PROGRESS

WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

LAYNE & BOWLER, INC. MEMPHIS

General Offices and Factory • Memphis 8, Tennessee

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

he'll need 26,000,000 gallons of water!

Every 7½ seconds another child is born!

By 1975, 221 millions of us will need water. To drink, bathe in, make and process our goods, grow our food . . . 26 million gallons apiece during each lifetime! Yet even *now* many parts of the nation face critical water shortages.

Any wonder water officials are worried and ask your help in assuring the nation's future water supply? Do your part.

1. Encourage future water planning.
2. Support realistic water rates and water supply bond issues.
3. Conserve water wherever you can.

Without water, what?

PROOF POSITIVE
Cast Iron Pipe
Saves You Tax Dollars

Still in service, this cast iron water main laid in Sacramento, Cal. over a hundred years ago is still piping water. This is typical of many century old cast iron water and gas mains now serving throughout America.

Small wonder that where long life, dependability and economy are "musts," water officials prefer cast iron pipe . . . No. 1 Tax Saver!

CAST IRON PIPE
RESEARCH ASSOCIATION
122 SOUTH MICHIGAN AVENUE, CHICAGO 3, ILLINOIS

MODERNIZED **cast iron**

YOUR JOB IS TO SUPPLY THEM!

And in these days of water shortages that job becomes increasingly difficult.

You know the facts about water. So do we. But the public must be made aware of them.

That's exactly what Cast Iron Pipe Research advertisements*. . . like the one opposite . . . are designed to do.

By educating Americans to the need for supporting and cooperating with your efforts to maintain their water supply, they make your job easier.

®
CAST IRON

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Ill.

*** *Appearing in:* Saturday Evening Post, Newsweek, U.S. News and World Report, Nation's Business.**

pipe FOR MODERN WATER WORKS

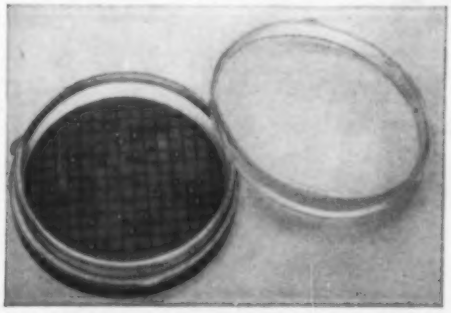
Water Testing

*APPROVED Water Pollution Control Technique

in the Laboratory

with the MILLIPORE FILTER STANDARD METHOD

NOW APPROVED as an alternate Standard Method for coliform testing, the MILLIPORE FILTER technique allows the determination of potable water quality to be carried out more RAPIDLY, more ECONOMICALLY, and with much greater ACCURACY than ever before possible. Results are obtained up to 5 times faster—in 16 to 20 hours—and with 2 to 5 times the precision of present broth tube methods. No tubes to wash, no breakage problems—the MF® technique saves valuable time, saves money, saves space.

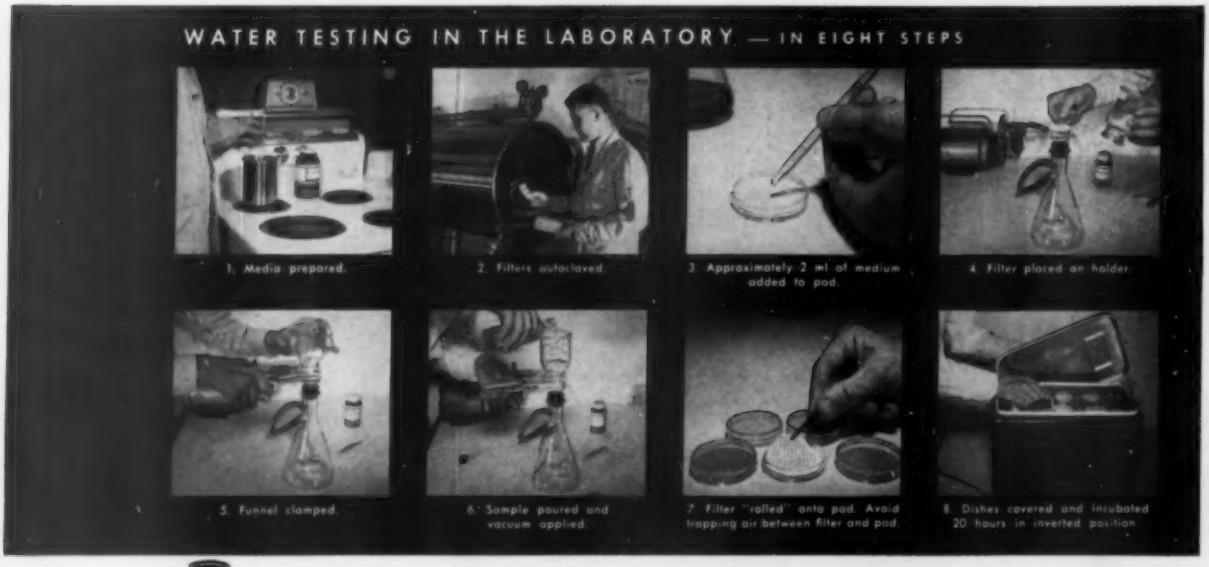


MILLIPORE FILTER in Disposable Plastic Petri Dish showing typical Coliform Bacteria Sheen Colonies, indicative of water contamination. MF® incubated for only 18 hours at 35°C.

MILLIPORE FILTERS are conveniently packaged in resealable Kraft envelopes—10 filters and nutrient pads per envelope—ready for immediate autoclave sterilization. Grid-marked to facilitate colony counting, the MF® may be readily filed as a permanent record of test results.

REGULATIONS SENSIBLY REQUIRE THAT PARALLEL TESTING OF THE MF® TECHNIQUE AND PRESENT METHODS be conducted in each laboratory to assure results of equivalent sanitary significance before adopting the new Standard Method. Full details on establishing MILLIPORE FILTER techniques in your laboratory are immediately available upon request.

Write for a copy of the new color-illustrated booklet,
"The MILLIPORE FILTER Standard Method of Water Bacteriology."


WATER TESTING IN THE LABORATORY — IN EIGHT STEPS
1. Media prepared.
2. Filters autoclaved.
3. Approximately 2 ml of medium added to pad.
4. Filter placed on holder.
5. Funnel clamped.
6. Sample poured and vacuum applied.
7. Filter "rolled" onto pad. Avoid trapping air between filter and pad.
8. Dishes covered and incubated 20 hours in inverted position.

MILLIPORE FILTER CORPORATION

36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS, U.S.A.

Water Testing

*APPROVED Water Pollution Control Technique

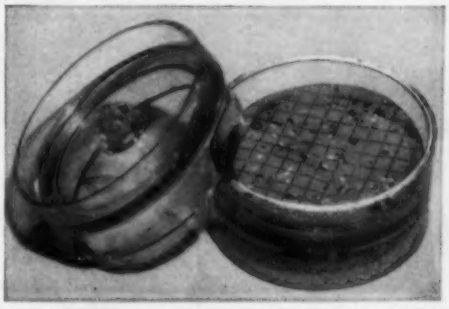
in the Field

with the MILLIPORE FIELD MONITORING KIT

EMPLOYING THE BASIC MILLIPORE FILTER TECHNIQUE, now approved as an alternate Standard Method for coliform testing, the FIELD MONITORING KIT yields accurate, direct field determinations of the bacterial content of waters in 18 to 20 hours. Used in conjunction with the Millipore Field Incubator, the FIELD MONITORING KIT is particularly adapted for use in rural areas or under disaster conditions where laboratory facilities are unavailable. In use by the World Health Organization, the FIELD MONITOR has also been recommended by the U. S. Navy for use by its Preventive Medicine Units.

SUPPLIED STERILE and ready for use, the FIELD MONITORING KIT contains two disposable plastic Monitor units which serve as combination filter holders and culturing dishes, two ampules of liquid nutrient medium, and two plastic sampling tubes. The Kit is packaged in a convenient mailing box to allow easy shipment if desired.

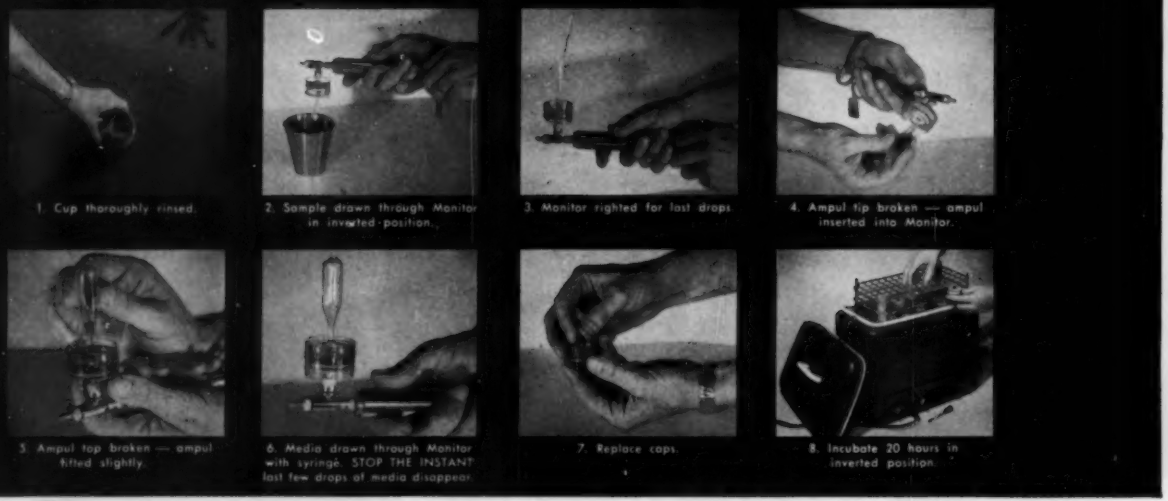
THE FIELD MONITORING KIT allows the sampling of large volumes of water, eliminates the cost and inconvenience of sample shipments in glass bottles, and requires no laboratory facilities. It is FAST, ACCURATE, REPRODUCIBLE AND ECONOMICAL.



FIELD MONITOR top removed to show Coliform Bacteria Sheen Colonies developed on the MF® surface after 18 hours of incubation.

***Write for a copy of the new color-illustrated booklet, "The MILLIPORE FILTER Standard Method of Water Bacteriology."**

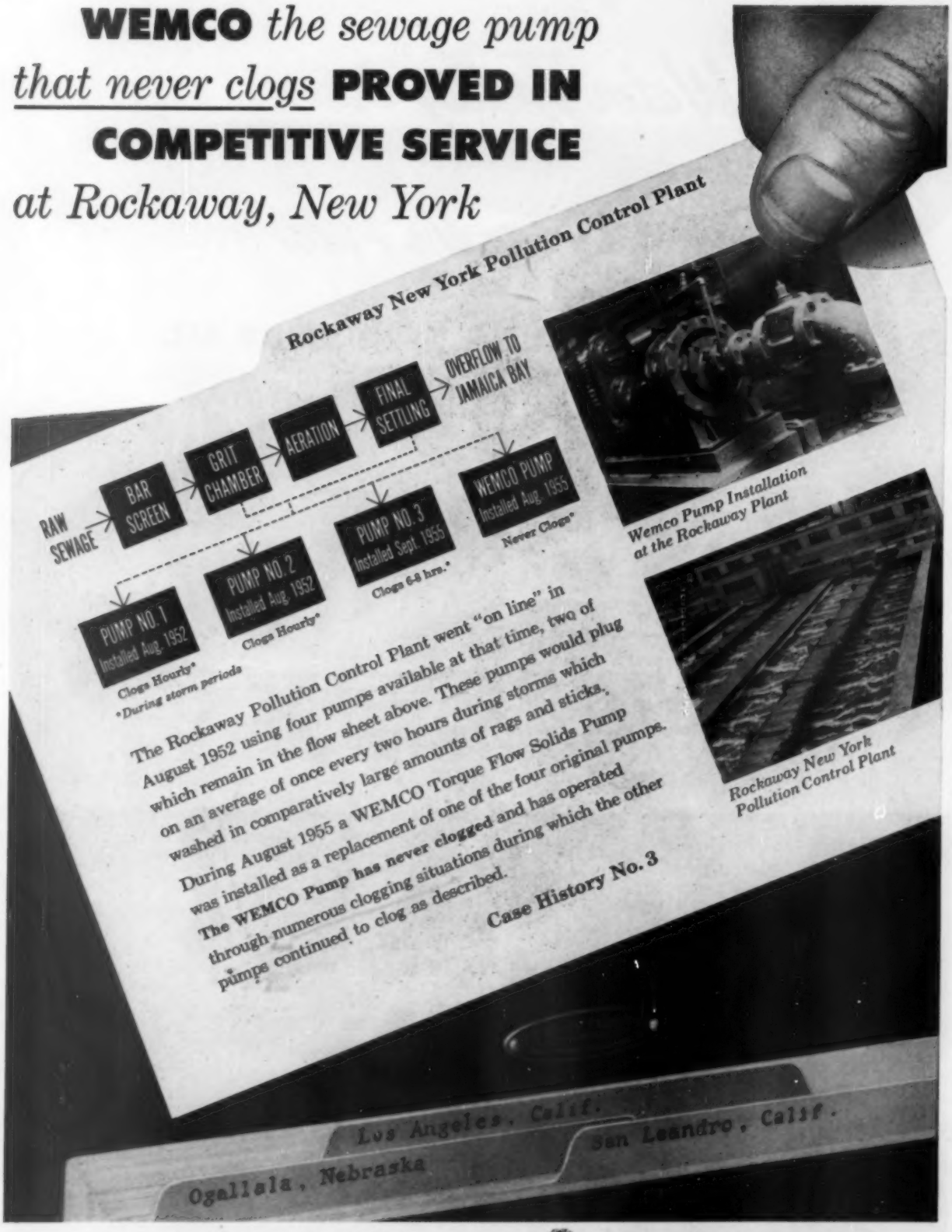
WATER TESTING IN THE FIELD — IN EIGHT STEPS


1. Cup thoroughly rinsed.
2. Sample drawn through Monitor in inverted position.
3. Monitor righted for last drops.
4. Ampul tip broken — ampul inserted into Monitor.
5. Ampul top broken — ampul fitted slightly.
6. Media drawn through Monitor with syringe. STOP THE INSTANT last few drops of media disappear.
7. Replace caps.
8. Incubate 20 hours in inverted position.

MILLIPORE FILTER CORPORATION

36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS, U.S.A.

WEMCO *the sewage pump* *that never clogs* **PROVED IN COMPETITIVE SERVICE** *at Rockaway, New York*


Rockaway New York Pollution Control Plant
RAW SEWAGE
BAR SCREEN
GRIT CHAMBER
AERATION
FINAL SETTLING
OVERFLOW TO JAMAICA BAY
PUMP NO. 1 Installed Aug. 1952
Clogs Hourly*
PUMP NO. 2 Installed Aug. 1952
Clogs Hourly*
PUMP NO. 3 Installed Sept. 1955
Clogs 6-8 hrs.*
WEMCO PUMP Installed Aug. 1955
Never Clogs*
*During storm periods
Wemco Pump Installation at the Rockaway Plant
Rockaway New York Pollution Control Plant
The Rockaway Pollution Control Plant went "on line" in August 1952 using four pumps available at that time, two of which remain in the flow sheet above. These pumps would plug on an average of once every two hours during storms which washed in comparatively large amounts of rags and sticks. During August 1955 a WEMCO Torque Flow Solids Pump was installed as a replacement of one of the four original pumps. **The WEMCO Pump has never clogged** and has operated through numerous clogging situations during which the other pumps continued to clog as described.
Case History No. 3
Los Angeles, Calif.
San Leandro, Calif.
Ogallala, Nebraska

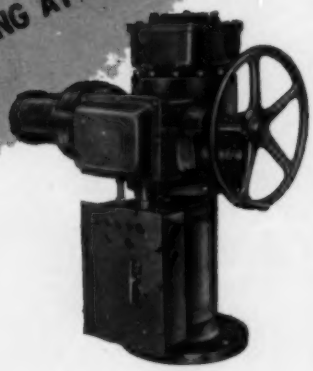
Wemco's unique torque-flow design has been responsible for many outstanding "never clog" records. The principle is fully explained in available literature. It will save you thousands of dollars in operating costs. Write today for your copy.

WEMCO
WESTERN MACHINERY COMPANY

650 Fifth St. • San Francisco 7, Calif. • Representatives in principal cities of the United States and Canada and in major countries throughout the world

LUDLOW VALVE ACTUATION

LUDLOW ENGINEERING AT ITS BEST



Motor Operated Stand with Integral Control Equipment.

Power actuation is available as a complete carefully engineered unit. Actuation may be by electric motor, air motor, or air or fluid cylinder type motivation. The power unit is compact and self contained, with sturdy supports which attach to the top of any Ludlow or Rensselaer Type Valve.

Manual operation is provided for all electric and air motor operated valves. Our engineers will be glad to help you lay out a plan based on our many years of experience in power actuation systems of all kinds for all purposes.

A wide selection of floor and bench stands, geared and non-geared, all types of indicators, check valves and air release valves are available for the modern pumping station.

19

MOTOR OPERATED VALVE

FLOOR STAND

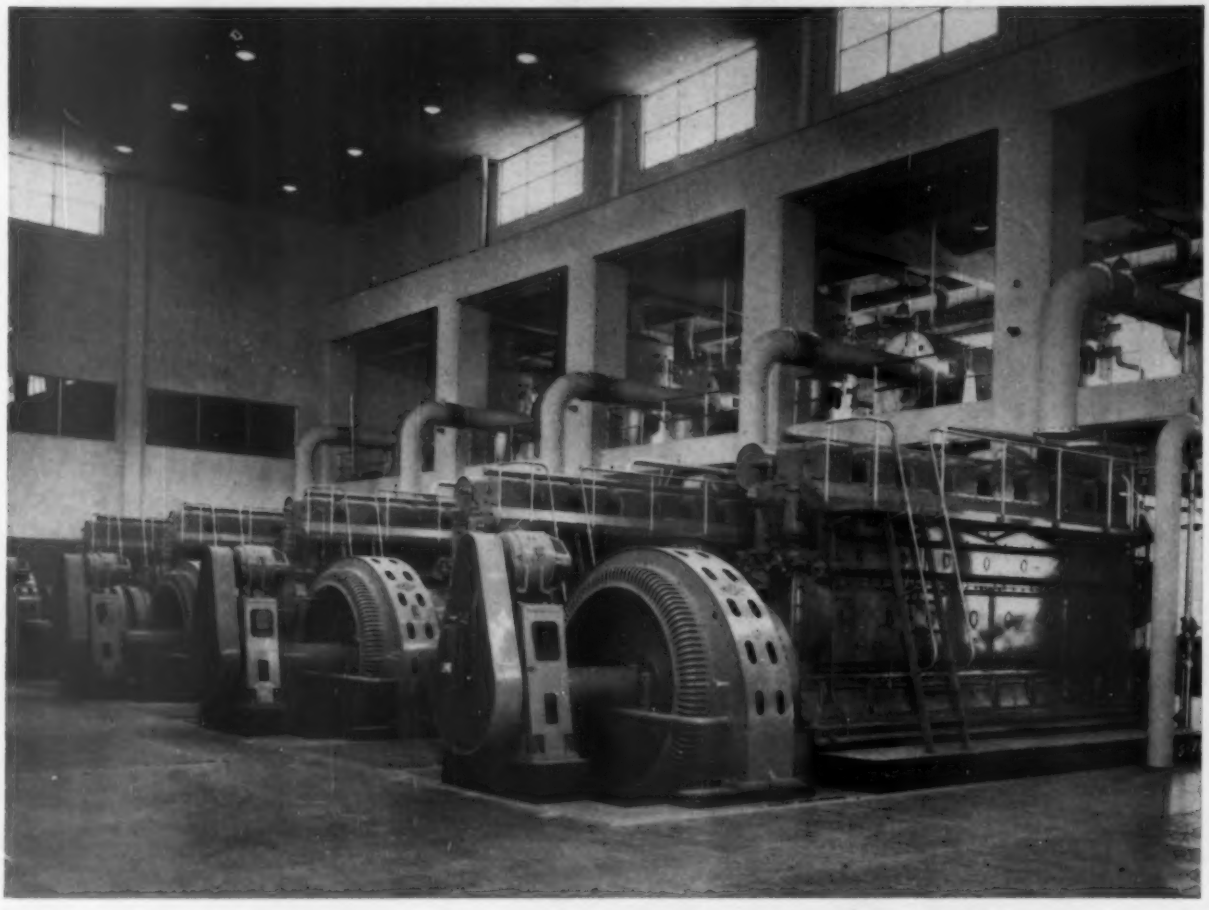
F-M INDICATOR POST

LUDLOW & Rensselaer

LUDLOW RENSSELAER VALVES & HYDRANTS

Since 1861 THE LUDLOW VALVE MANUFACTURING CO. Troy, N. Y.

"One of the most outstanding operational records in sewage treatment and engine operation" reports Diesel Progress about the Hyperion Activated Sludge Plant of the City of Los Angeles.



10 Worthington engines chalk up 293,899 hours and not one ring, liner, or bearing wore out!

ENGINE	OPERATING HOURS
No. 1	28,928
No. 2	31,163
No. 3	26,926
No. 4	30,422
No. 5	25,648
No. 6	34,472
No. 7	38,367
No. 8	33,785
No. 9	33,753
No. 10*	10,435

*Installed Oct., 1954

In six years of operation, the nine original Worthington engines averaged over 31,000 hours each.

Operating on methane produced in Hyperion's digestion facility, the Worthington engines are turbocharged dual-fuel units rated at 1688 hp each. In six years the ten engines have run 293,899 hours without wearing out a piston ring, cylinder liner, or bearing.

No. 7 Good for 100,000 Hours

Engine No. 7, first on the line, is typical. This engine has 38,367 hours on its original rings. After a routine overhaul, Hyperion engineers predicted a life of 100,000 hours —equivalent to 11 years of continuous operation—per set of rings. They expect double this life for the cylinder liners.

Good Operation

Of course, the finest piece of equipment would not give such an outstanding record without careful attention to such items as lubrication, clean fuel, temperature control, etc. Good operation is the watchword at Hyperion and annual overhauls, including checking of all operating parts, back up the high quality of the Worthington equipment.

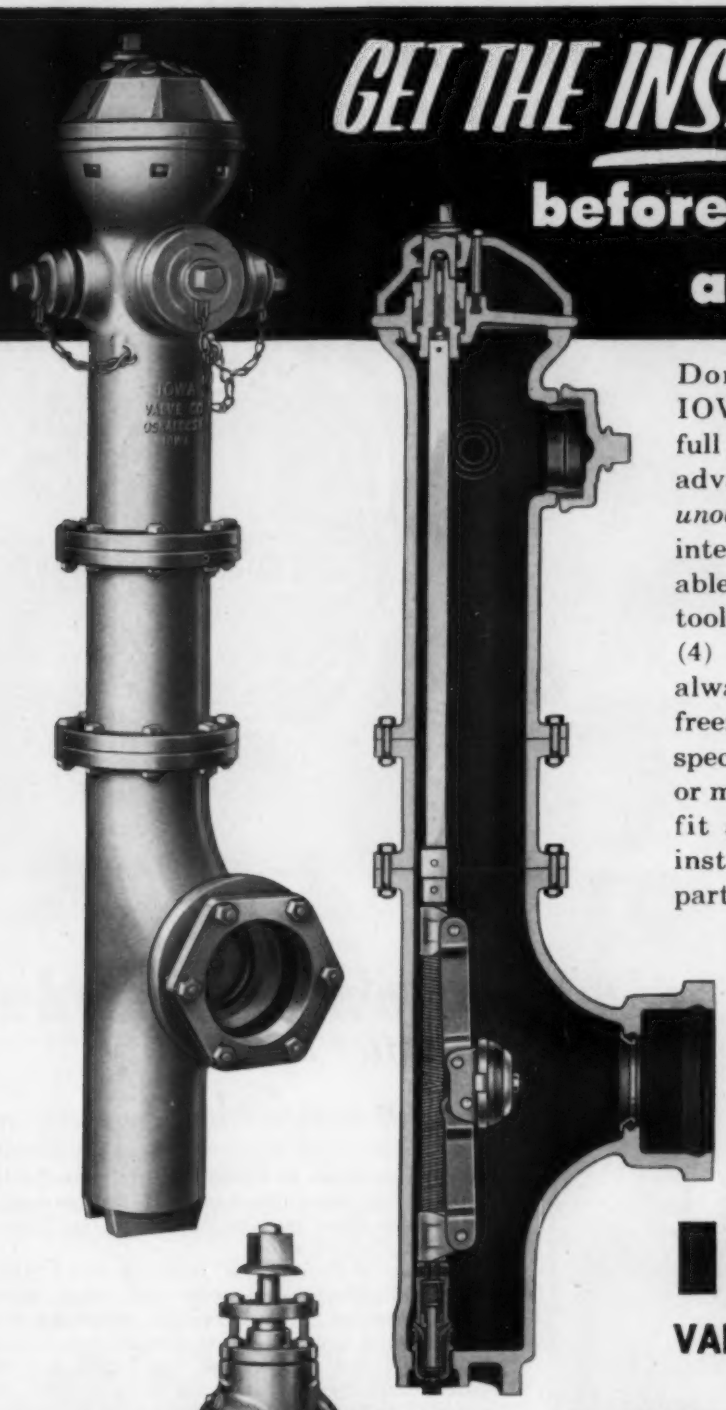
Full Report Available

If you would like a reprint of "Hyperion's Six Years of Operation," an interesting article about the plant and its many maintenance innovations, please write to Section W63, Worthington Corporation, Harrison, N. J. Ask for Bulletin RP-928. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ont. W.63

WORTHINGTON

GET THE INSIDE STORY

before you specify any hydrant!



Don't buy blindly! Only in IOWA hydrants do you get full measure of such practical advantages as: (1) absolutely *unobstructed* waterway; (2) all internal working parts removable through top; (3) no special tools needed for maintenance; (4) no binding or distortion, always easily opened; (5) no freezing; (6) meet all A.W.W.A. specifications; (7) bell, flange or mechanical joint connections fit any existing or planned installation; (8) replacement parts always available.

that's why farsighted city officials choose

IOWA

VALVES AND HYDRANTS

for COMPLETE details, address:

IOWA

VALVE COMPANY

A Subsidiary of James B. Clow & Sons, Inc.

Oskaloosa, Iowa

Part of the skyline at FARGO, NORTH DAKOTA

PITTSBURGH • DES MOINES ELEVATED STEEL TANKS

— and indispensable to better community water service!

Integral elements in Fargo's general plan for improved city water pressure and fire protection service are these modern Pittsburgh-Des Moines elevated steel tanks.

At top is shown the newly-erected PDM 1,000,000-gallon radial cone tank, built across town from the pumping station, supplying both a residential area and North Dakota Agricultural College. Below is pictured the PDM 500,000-gallon double-ellipsoidal tank built in 1952, located in the business district for always-available fire protection. (The privately-owned roof-top industrial tank is also by PDM!)

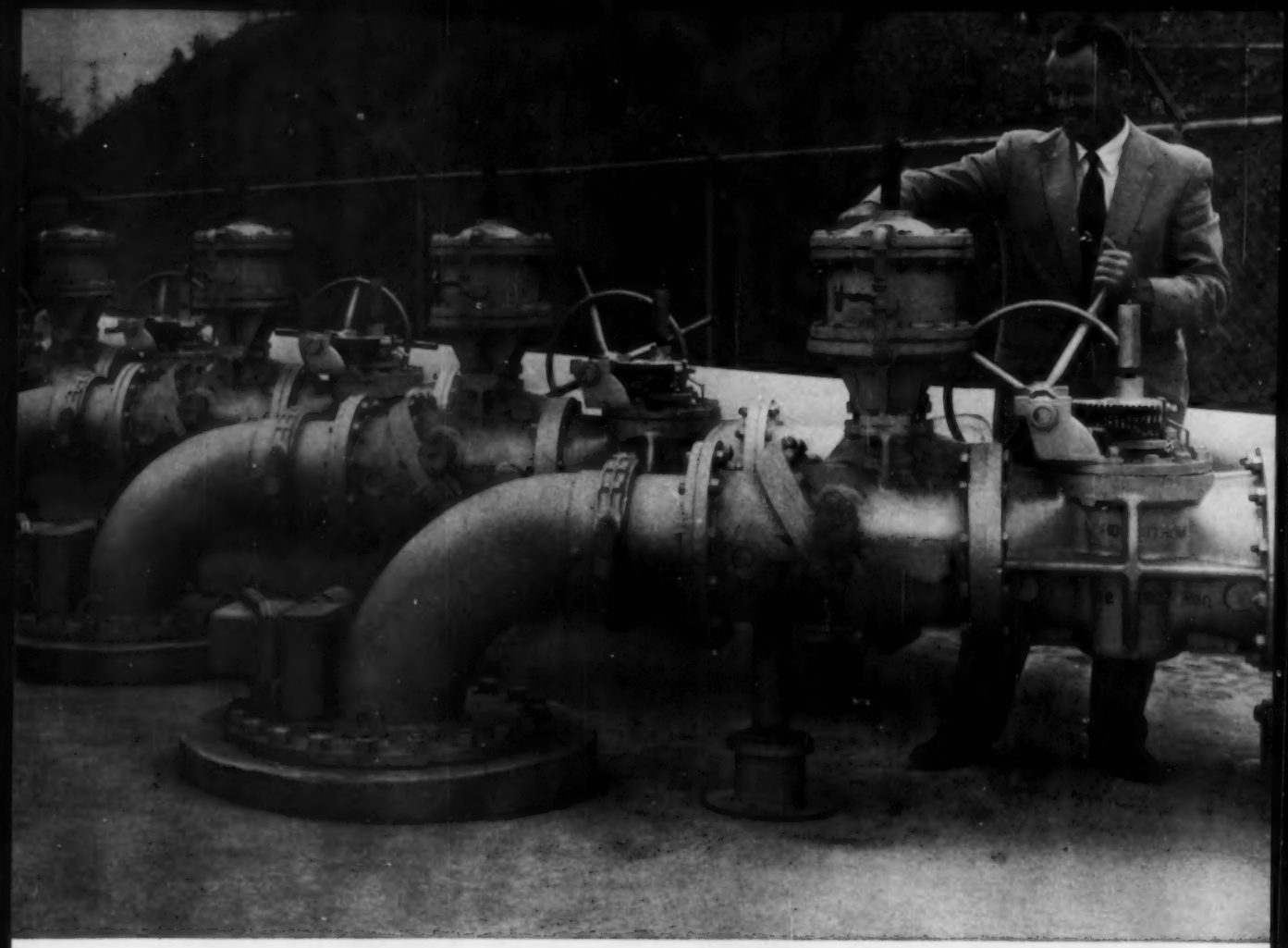
Write for your free copy of our 28-page Elevated Tank Catalog, illustrating and describing the various types in detail.

PDM
ELEVATED STEEL TANKS

PITTSBURGH • DES MOINES STEEL CO.
Plants at PITTSBURGH, DES MOINES, SANTA CLARA, FRESNO, and CADIZ, SPAIN

Sales Offices at:

PITTSBURGH (25) . . . . 3418 Neville Island
NEWARK (2) . . . 218 Industrial Office Bldg.
CHICAGO (3), 1222 First National Bank Bldg.
EL MONTE, CAL. . . . . P. O. Box 2068
DES MOINES (8). . 919 Tuttle Street
DALLAS (1). . 1223 Praetorian Bldg.
SEATTLE . . . . . 526 Lane Street
SANTA CLARA, CAL., 649 Alviso Road
MADRID, SPAIN . . . Diego DeLeon, 60



Takes the "work" out of water works

Most water works valves are a lot of work in terms of operation and maintenance. Rockwell-Nordstrom lubricated plug valves save work (and money) because the combination of *lubricant* and a *tapered plug* means easy, trouble-free operation. Pressurized lubricant sealing assures positive shut-off with a smooth, easy quarter-turn. And the tapered plug and lubricant hydraulic jacking action mean *fast, easy* operation . . . stuck valves are eliminated.

Lubrication of any mechanism is preventive maintenance. For this reason Rockwell-Nordstrom valves cost far less to use and stay in service longer than any other valve.

Rockwell-Nordstrom valves—and a *complete* line of valve accessories—are available in sizes and pressure ratings for every water or sewage and waste plant service. They cost no more to buy, often less, than ordinary valves and they'll save you money everywhere you use them. Fill in the coupon for complete details. Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Limited.

ROCKWELL—
Nordstrom
VALVES

LUBRICANT SEALED FOR
POSITIVE SHUT-OFF

Rockwell Manufacturing Company
Pittsburgh 8, Pennsylvania

☐ Please send me Bulletin C-5200.
☐ Please have your sales engineer call.

Name_____ Title_____

Address_____

City_____ Zone_____ State_____

U.S.
$51
BILLION

Nation's Huge Highway Program Will Call for Many Miles of NEW WATER MAINS

Plans for the vast $51 billion nation-wide highway building program, which gets under way this year, will involve the re-routing of many municipal thoroughfares. It is also certain to result in still further decentralization of urban centers, since new and improved highways will spur development of outlying areas. These two factors deserve consideration of every city that is studying its future water main requirements.

In this or any other water system planning, long run economy dictates the choice of —

PERMANENT

CAST IRON PIPE

This is the only pipe that has stood the test of time. Because of its century or more of useful life, its high capacity as a carrier and negligible maintenance cost, Cast Iron Pipe has earned its reputation as

"America's No. 1 Tax Saver."

Our Company does not manufacture pipe but has long supplied the nation's leading cast iron pipe manufacturers with quality iron from which pipe is made.

WOODWARD IRON COMPANY
WOODWARD, ALABAMA

Improve your safety program with the new Hooker chlorine wall chart

Since chlorine is as safe as the people who handle it, you can help ward off accidents by instructing your employees on safe handling methods.

In concise, easy-to-understand terms, the new Hooker chlorine wall chart lists some precautions to be observed in handling tank cars, cylinders, and ton containers of chlorine.

It tells some of the things to do and, equally important, some of the things not to do, with chlorine.

It contains sections on first aid and emergency methods—advice that can minimize the effects of an accident should it occur.

Mail the coupon for a copy of this chart today. The wall chart supplements in easy-to-post form more complete and detailed engineering and safety information found in the 76-page book, "Hooker Chlorine."

HOOKER CHEMICALS PLASTICS

HOOKER ELECTROCHEMICAL COMPANY
1702 UNION STREET, NIAGARA FALLS, N. Y.

Niagara Falls · Tacoma · Montague, Mich. · New York · Chicago · Los Angeles

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Please send me a copy of the Chlorine Safety Chart.

Name.....

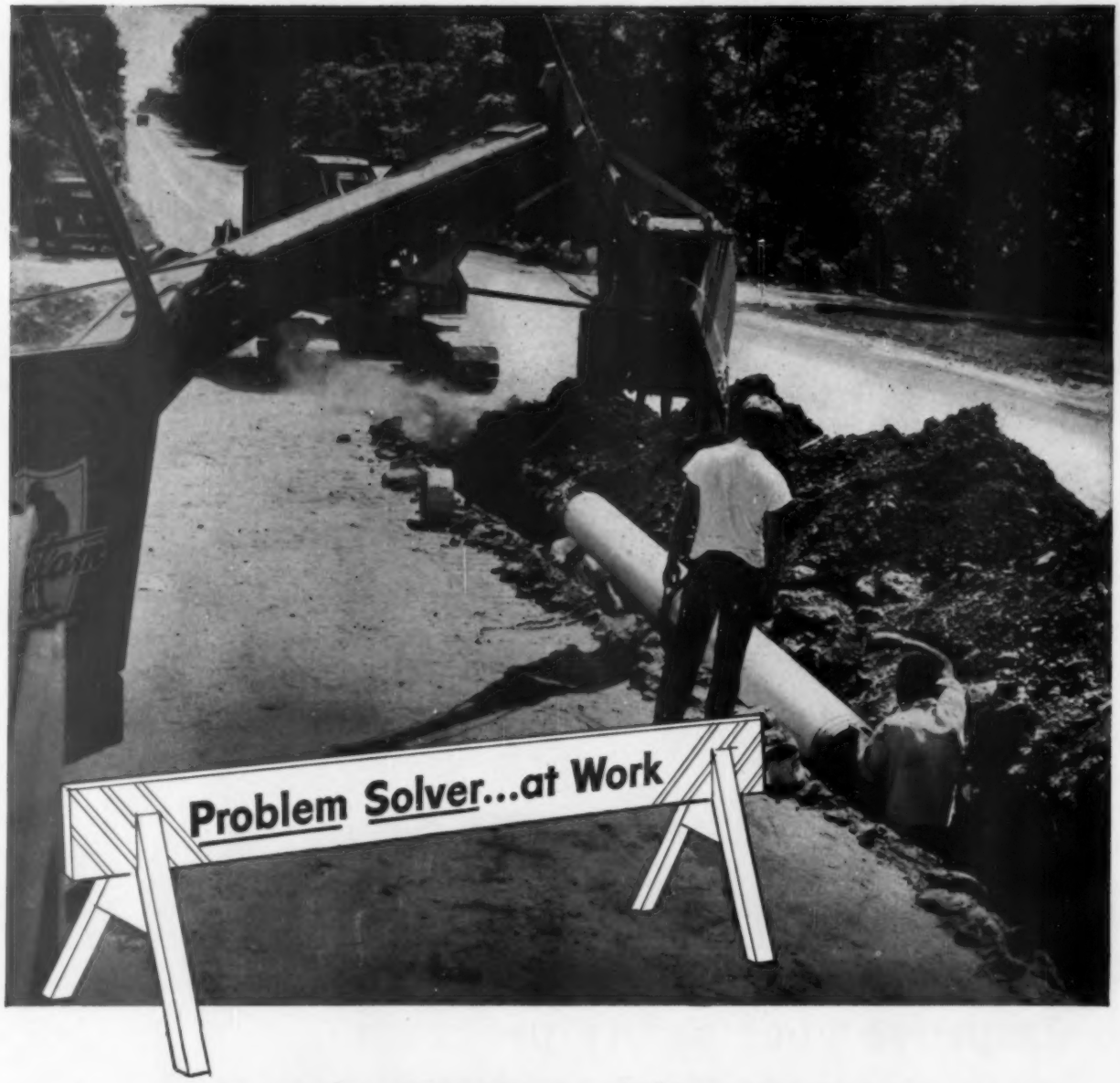
Title.....

Company.....

Address.....

City..... Zone.....

State.....



Transite Pressure Pipe assures dependable service through the years

ENGINEERS and city officials face much the same problem in pipe selection. It is twofold: (1) How to make sure the community gets many long years of trouble-free performance from its pressure mains, and (2) How to do this as economically as possible by choosing pipe for durability plus savings.

Transite® Pressure Pipe is solving this problem in hundreds of municipalities and water districts from coast to coast. Here's why. An asbestos-cement product, strong and durable and highly resistant to corrosion, it has effected economies in installation as well as operation.

For example, the community benefits even at the very outset, since both handling and assembly of Transite Pressure Pipe are so simple that crews can install as fast as trench is opened. This means lower installed costs.

Another Transite Pipe characteristic instantly recognized by engineers as of major importance is its smooth interior that stays smooth. This provides maintained high flow capacity. (Flow coefficient is C-140.)

* * *

For further information about Transite Pressure Pipe with the Ring-Tite® Coupling, write for Booklet TR-160A. Address Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JM PRODUCTS

Johns-Manville TRANSITE PRESSURE PIPE
WITH THE RING-TITE® COUPLING

MUELLER®

AWWA IMPROVED FIRE HYDRANTS

OIL FILLER PLUG
Check oil level quickly with dipstick and add oil if needed without removing bonnet.

OIL RESERVOIR
Positive, automatic lubrication of all stem threads and bearing surfaces each time hydrant is operated.

"O" RING SEALS
Permanent, water-tight seal without packing adjustments or stem binding.

SAFETY FLANGE AND SAFETY STEM COUPLING
Prevent damage and permit convenient facing of nozzles, addition of extension sections or changing of upper barrel for different nozzle arrangements quickly, easily, inexpensively . . . all without digging or water shut-off.

BRONZE WEATHER CAP
Prevents freezing of operating nut and discourages tampering.

DRY TOP DESIGN
Operating threads and bearing surfaces sealed from water.

BREECH-LOCKED NOZZLES
Interlocking lugs and calking prevent blow-out. Easily removed if necessary.

NON-KINKING CHAINS
Each chain individually attached directly under nozzle.

. . . designed for **ABOVE-GROUND MAINTENANCE!**

BRONZE SEAT RING
Straight threads and copper asbestos gasket permit easy removal of seat ring.

BRONZE CAP NUT
Locks and seals stem threads to prevent corrosion.

COMPRESSION-TYPE MAIN VALVE
Closes with water pressure . . stays closed without strain . . permits repairs or changes without water shut-off.

DOUBLE DRAIN OPENINGS
Automatically force-flushed each time hydrant is operated.

Consult your Catalog W-96, your Mueller Representative, or write for full details.

MUELLER CO.
DECATUR, ILL.

Since 1857

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

CONCRETE PIPE

backbone of 72-mile aqueduct

The San Jacinto-San Vicente Aqueduct carries Colorado River water 72 miles to the San Vicente Reservoir near San Diego, California. The first barrel was completed with concrete pipe in 1947. When a second barrel was needed concrete pipe was specified again.

Built by the Bureau of Reclamation, the giant aqueduct is constructed of two types of concrete pipe: Non-cylinder pipe for hydrostatic heads up to 100 feet and a reinforced cylinder type for heads from 100 to 650 feet. Concrete pipe of 72-, 60-, 54- and 48-inch sizes was used. The photo shows a 48-inch pipe before backfilling.

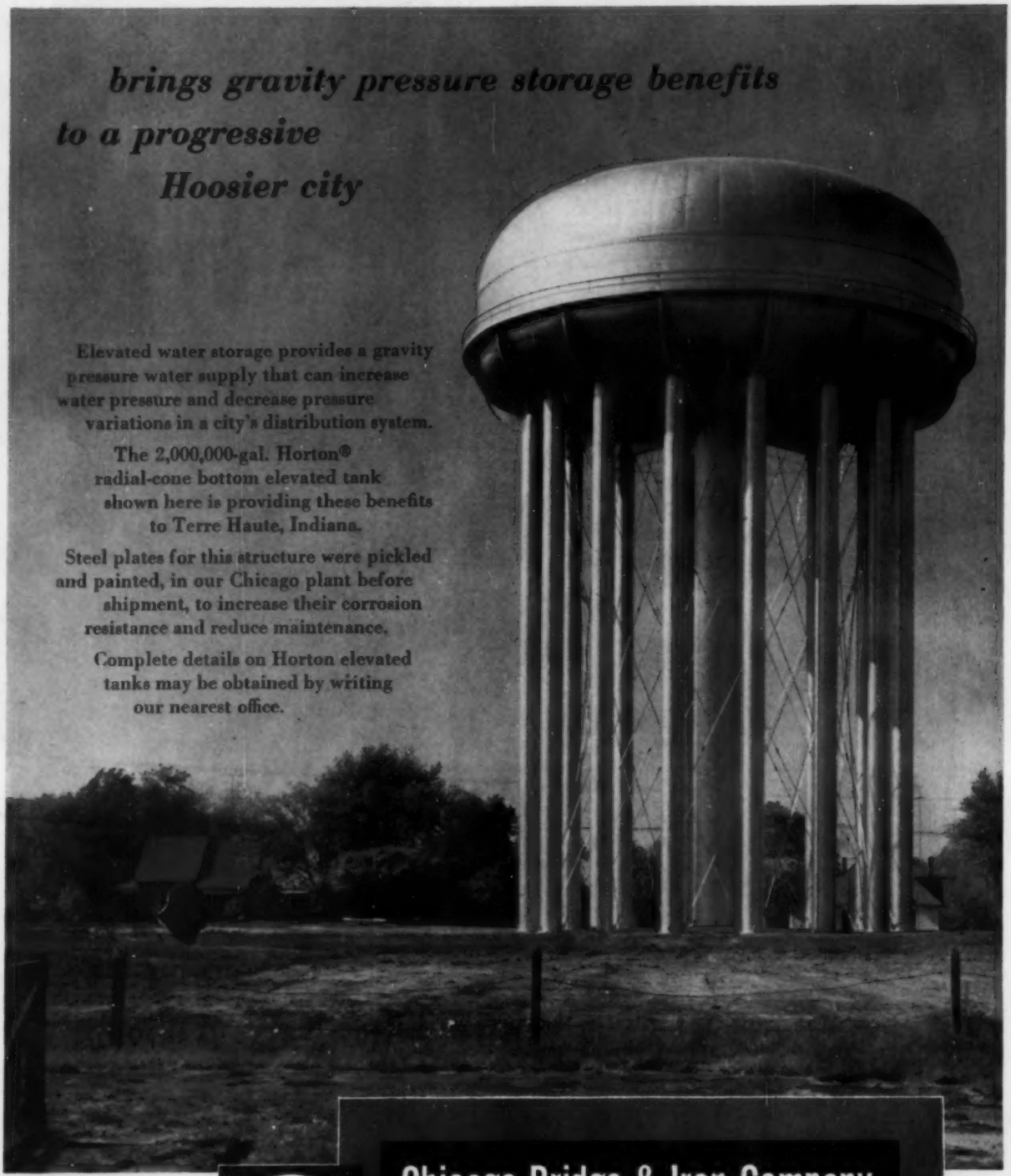
Concrete pipe's smooth, non-corroding interior surface gives maximum hydraulic efficiency. Its dense structure and tight joints prevent leakage and infiltration. Its moderate first cost and low maintenance cost add up to real ***low annual cost.***

PORTLAND CEMENT ASSOCIATION

33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete... through scientific research and engineering field work

2,000,000-gal. Horton Elevated Tank

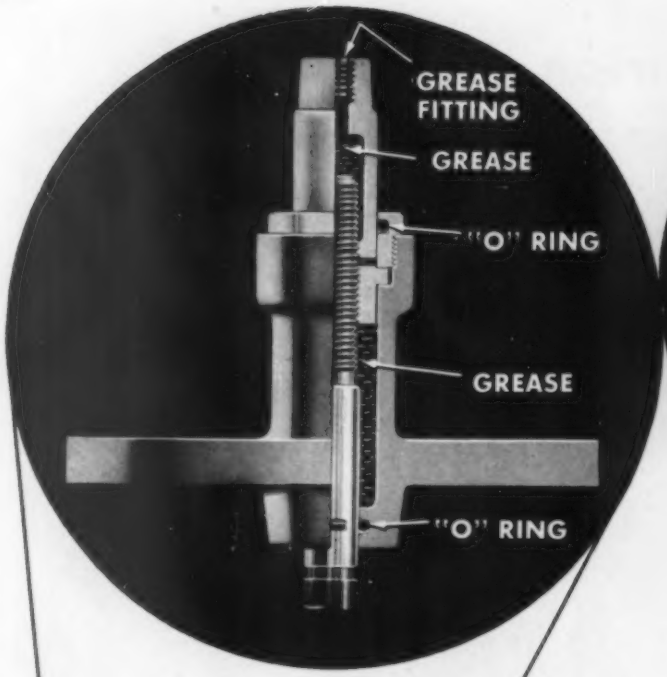

brings gravity pressure storage benefits
to a progressive
Hoosier city
Elevated water storage provides a gravity pressure water supply that can increase water pressure and decrease pressure variations in a city's distribution system.
The 2,000,000-gal. Horton® radial-cone bottom elevated tank shown here is providing these benefits to Terre Haute, Indiana.
Steel plates for this structure were pickled and painted, in our Chicago plant before shipment, to increase their corrosion resistance and reduce maintenance.
Complete details on Horton elevated tanks may be obtained by writing our nearest office.

CBI

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

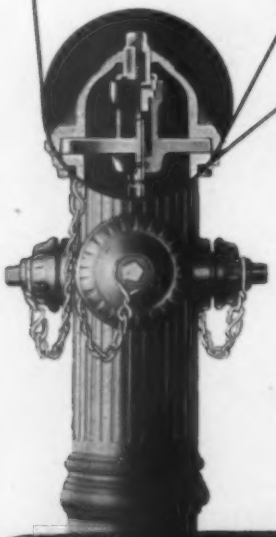
2,000,000-gal. Horton radial-cone bottom elevated tank erected at Terre Haute, Ind.



NEW DOUBLE FEATURE

SMITH[48] HYDRANTS

WITH "O" RING-SEAL AND GREASE CHAMBER FOR OPERATING THREADS



When you specify "O" Ring Seals rather than conventional packing you reduce maintenance to a minimum. The lower "O" Ring is the pressure seal, the upper "O" Ring the dirt seal. The initial compression of the "O" Rings provides the seal when the hydrant is closed. When subject to water pressure the lower "O" Ring is forced to the top of the groove. The sealing force increases as the pressure increases. The specially compounded rubber plastic "O" Rings insure a long life pressure seal. Each time the hydrant is operated, the "O" Ring Seals, the bearing surfaces, and the operating threads are automatically lubricated. Threads and upper section of the stem are continuously lubricated and sealed from contact with water in the standpipe. The lubricant is suitable for temperatures of minus 30 degrees to 200 degrees. All Smith Hydrants including hydrants in service can be fitted with "O" Ring Seal Plates.

FIRE HYDRANTS · VALVES · SINCE 1896 ·

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

IT LOOKS LIKE A SWANK CABANA CLUB, but this impressive establishment actually is the new sewage treatment plant at Coral Gables.

Beauty Comes to Sewage Treatment

Murals adorn the new sewage treatment plant on the main street of Coral Gables, Florida

How times change! Until recently, you would normally expect to find the sewage treatment plant on the wrong side of the tracks, hidden away in an isolated spot. Today, however, proper equipment positively controls odors, and attractive landscaping provides a pleasing appearance. As a result, cities can now build in the most practical location. And often a plant that's close-in saves miles of costly sewer installations.

Coral Gables selected its plant site on Ponce de Leon Boulevard, the city's main thoroughfare. A pleasant and attractive sewage treatment plant was constructed, and the digesters equipped with P.F.T. Floating Covers for efficient "controlled digestion". Then, with a burst of inspiration, the city commissioned a well-known artist to beautify the walls of the digestion tanks with historical murals. And so, in a state where nothing seems surprising, the sparkling new sewage treatment plant at Coral Gables has become a magnificent civic showplace!

continued next page

CLASSROOM FACILITIES in the main building enable students of sanitary engineering at the University of Miami to attend laboratory sessions at the plant.

"Operation Health and Beauty"

At present, the new Coral Gables plant will handle a design flow of 2.5 million gallons of sewage per day. It can be expanded to treat a total of 7.5 mgd. This modern plant includes P.F.T. "controlled digestion", and is an important forward step in Florida's outstanding program of pollution abatement.

The murals decorating the digestion tanks were painted by well-known artist John St. John. They are the first monumental historical murals in the U.S., and depict by authentic symbols eight epochs of Florida history: Florida of the Aborigines, the Discovery, Initial Struggle for Power, Spanish Colonialism, English Settlement, Early Years of Statehood, Development of the Southeast Coast Area, and Coral Gables.

Design of plant by: Smith and Gillespie, Consulting Engineers of Jacksonville, Florida.

Direction of overall sewer projects by: M. B. Garris, Consulting Engineer of Miami.

P.F.T.

waste treatment equipment exclusively since 1893

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DESIGNS on the North Digester represent the last 150 years of Florida history, from the early years of statehood, on through development of the area, up to the present.

HISTORIC SYMBOLS on the South Tank portray the work, play and times of the native Indian, and the first 300 years of history following Florida's discovery.

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—a TAMPER

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- One Machine...One Operator Does it All
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With a Chapman Tilting Disc Check Valve, there's no noise, no vibration, no fluttering. There's no banging or slamming with damage to system or valve. There's no scraping or wearing of disc and seat. Your head loss or flow resistance is kept at a minimum.

To put it briefly, with a Chapman Tilting Disc Check Valve, there's little or no maintenance even under severe operating conditions.

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Never a Flutter, Never a Slam!

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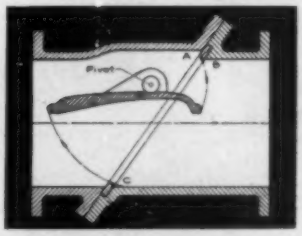

In open position, specially designed "airfoil" disc balances perfectly. No vibration. No flutter. When flow subsides, disc drops quickly and quietly to a tight closed position. No jarring. No slamming. No damage to system or valve. Note enlarged area around disc to insure low flow resistance.

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Tests for insolubles taken from these random samples show you that Morton Purex is the only one that contains no wasteful sludge, or insolubles.

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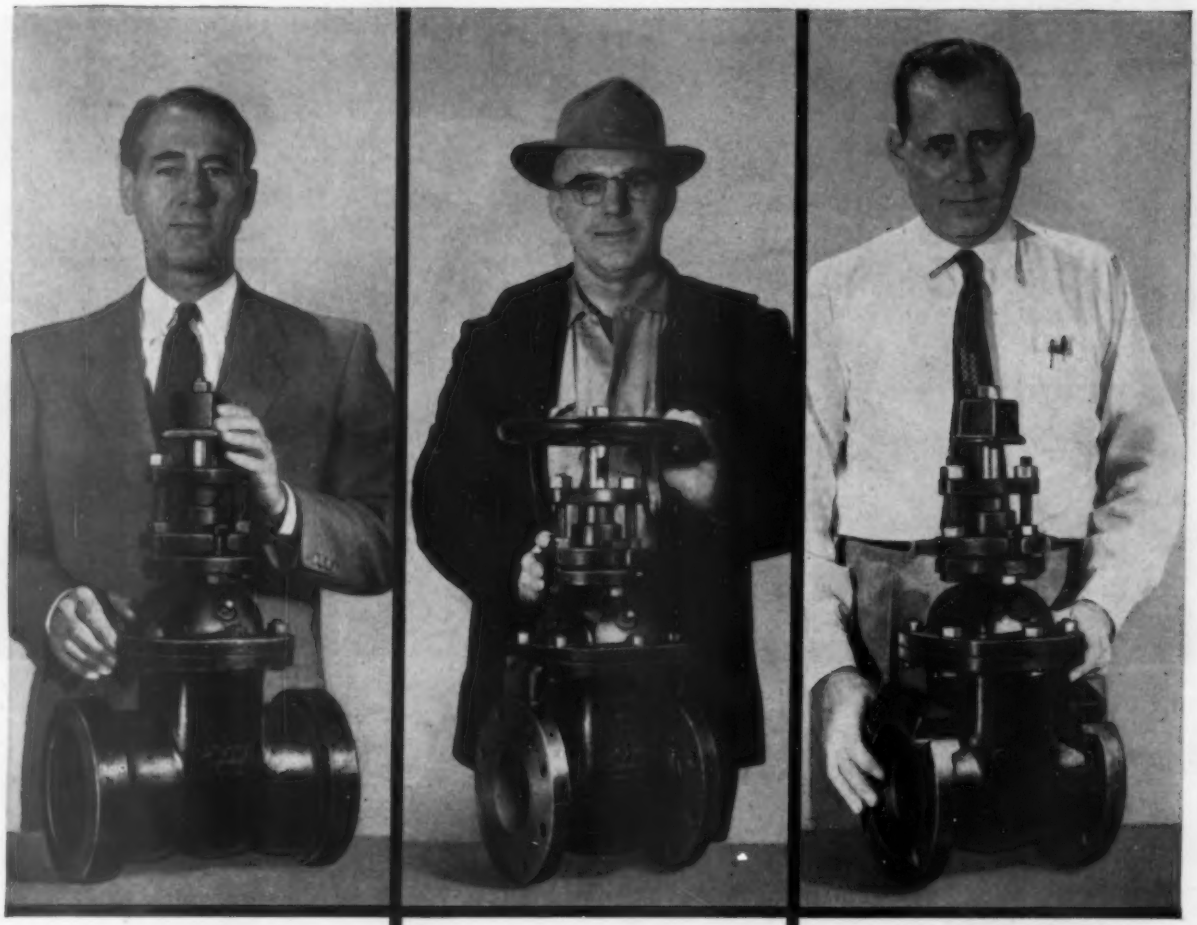

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These new gate valves feature free-to-rotate discs that prevent concentrated wear on seating surfaces . . . simplified wedging action that assures positive seating . . . disc flange guides that hold the disc assembly in close alignment for maximum operating efficiency and minimum wear . . . and strict compliance with *all* A.W.W.A standards for gate valves for ordinary water works service.

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New Crane A.W.W.A. valves come in all sizes from 2 to 12 in. Circular AD-2108 will give you complete technical data and help in your selection. Get a copy from your local Crane Representative, or write to address below. No obligation.

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Today's water Supply-

is your community's most valuable asset!

Badger Meters provide a precise check on usage and waste . . . first logical step towards conservation.

This perplexed citizen is a victim of water shortage — fast becoming a major problem in many communities. The tools he holds in his hands hardly equip him to fight for his rightful share — *he needs help from his water department.*

What YOU do *now* to safeguard *present water* supplies — to prevent situations like this —may play an important part in future development of your own community.

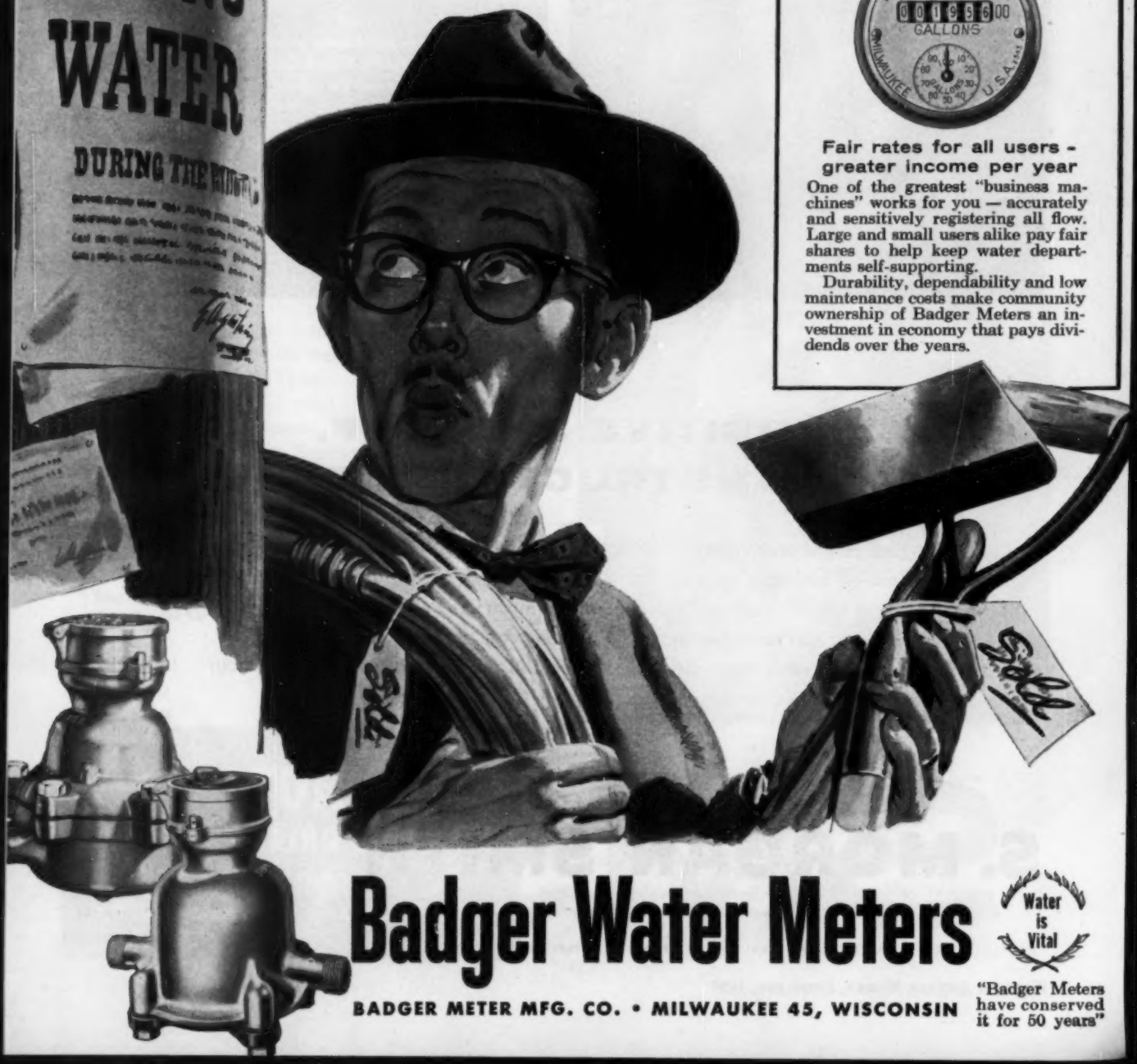
Metering all water for residential and industrial use is the first logical step towards knowing *where* and *how much* water is used—or wasted. Studies prove that water use in metered cities is reduced by as much as 33%.

Metering your water supply is a step made easy by the Badger Meter representative in your area. He can furnish complete data on many types of Badger Meters best suited for the specific needs of your community. For an appointment, at your convenience, write direct.

Fair rates for all users - greater income per year

One of the greatest "business machines" works for you — accurately and sensitively registering all flow. Large and small users alike pay fair shares to help keep water departments self-supporting.

Durability, dependability and low maintenance costs make community ownership of Badger Meters an investment in economy that pays dividends over the years.



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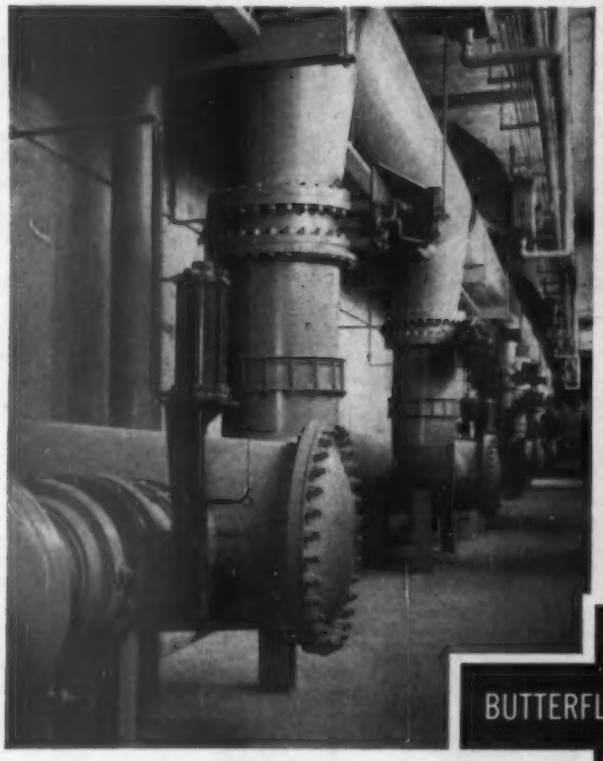

FOR HIGH-PRESSURE SERVICE SMS Babbit-Seated Butterfly Valves are built to give tight shutoff and meet the rugged demands of high-pressure service. They are available for shutoff pressures up to 200 psig, and for a wide range of velocities, including open-end free discharge.

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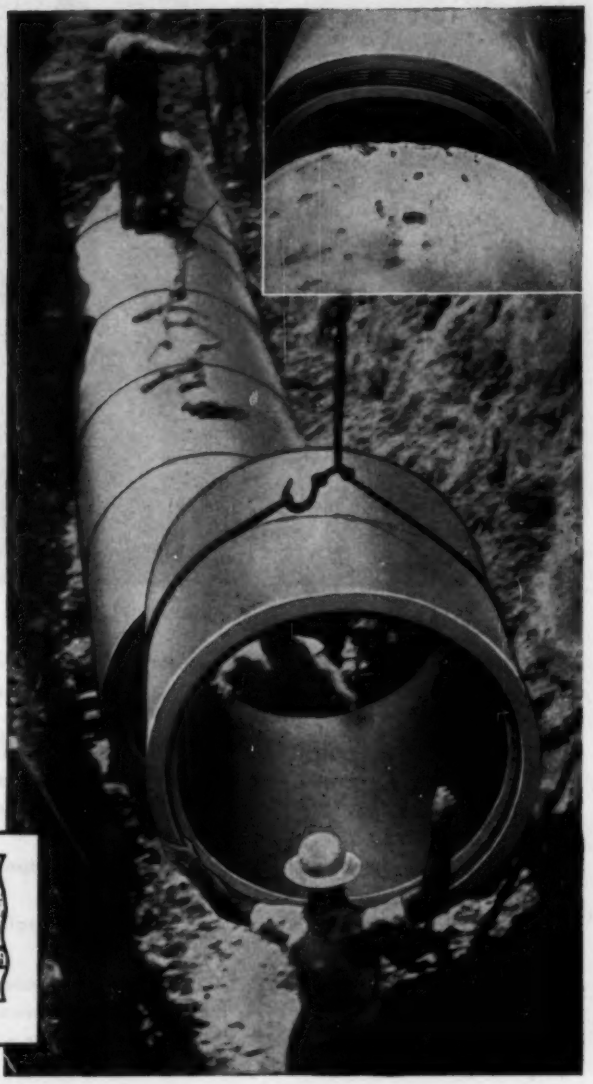
THIS ONE IS "LEAK-PROOFED FOR LIFE"* WITH

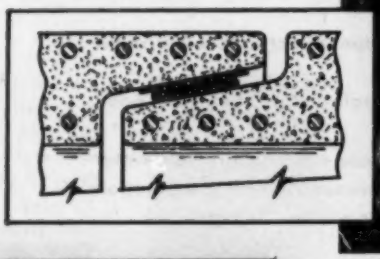
TYLOX *flexible* RUBBER PIPE JOINTS



This sewer line in *CORPUS CHRISTI, TEXAS won't have to be dug up in a few years because of leaky or failing joints! In specifying TYLOX Rubber Gaskets, engineers and city officials took advantage of a coupling material **known** for its non-deteriorating, ageless qualities . . . for its ability to make sewerage and drainage pipe joints leak-proof and root-proof for the life of the pipe itself.

But that's not all . . . along with the certainty of permanently water-tight pipe joints, their TYLOX specification assured faster construction and lower job costs. **Flexible** TYLOX is quickly assembled to the pipe, and permits fast assembly of the line. It compensates for pipe angularities . . . permits wet trench jointing . . . immediate backfilling.

TYLOX is the **one** pipe joint that meets the requirements of engineers, sanitary officials and construction men alike. Specify TYLOX on your pipe jobs.



This rubber-tight seal STAYS tight "for the life of the line".

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ENGINEERS: For City of Corpus Christi, Texas — Drahn Jones, Dir. of Public Works, and Klyde Z. Huston, Engineer

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But water meters, being fine instruments, naturally lose accuracy after years of wear. They start to give away revenue. They permit leaks and carelessness to creep back, and pumping costs go up. Eventually the water system cannot cope with the growing demand.

Worse yet, lack of proper income makes people hesitant to act, and water shortages may soon become critical.

How guard against this? Pick meters that stay accurate longer. Set up a good testing and repair program.

Walk into your meter repair shop. Talk to the men whose efforts guard your water supply. Ask them which meter gives highest sustained revenue . . . with lowest repair and depreciation costs. We sincerely believe the answer will be "Trident."

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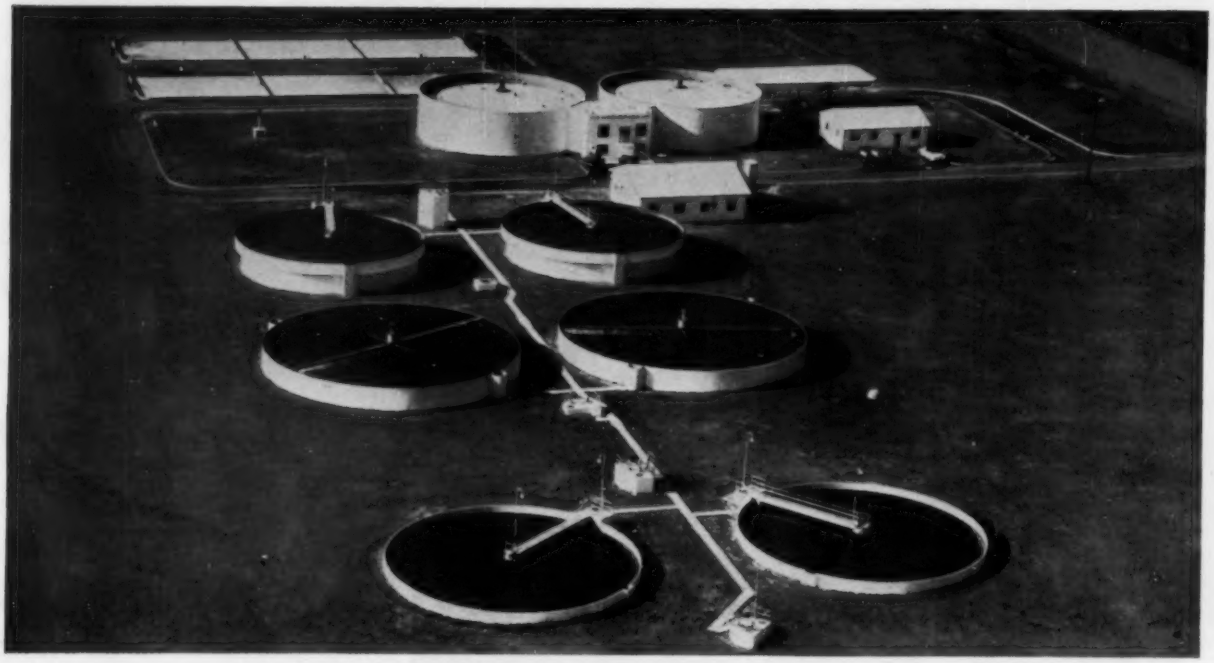
WATER & SEWAGE WORKS

VOL. 104, NO. 2 • A Scranton Gillette Publication • FEBRUARY, 1957



HOLLYWOOD, FLA. boasts a new and neat 3 mgd "Biofilter" plant. Photo by Dorr-Oliver

Sewage and Industrial Wastes in 1956

A review of problems, developments and trends of the year

by EMIL C. JENSEN*

The author is chief of the Division of Engineering in the Washington State Department of Health, Seattle, Wash. He holds the degree of Master of Science in Engineering from Harvard University.

*Currently Mr. Jensen has the distinction of being president of the Federation of Sewage & Industrial Wastes Ass'ns.

STOP, LOOK, and LISTEN! As the year 1956 ends, and the new year begins we may ask: Do the trends and developments in waste disposal practices indicate an ability and readiness to handle the problems of tomorrow? Are there too many ties to the conventional way of doing things? Is the planning ahead sufficiently divorced from past solutions for us to be fully objective and unhampered rather than stereotyped?

This query is directed to all things involved in accomplishing waste treatment and pollution control. If the job were only one of conceiving the engineering design of the treatment works, even considering the increasing complexity of waste characteristics, and the fact that there is yet much to be learned in respect to methods for their treatment and their effects in the water courses, it would be relatively simple.

The big challenge rests in the attempt to fit the technical solutions into the economics of the situation. This will require a bilateral approach; there will have to be vigilant effort to pare costs along with an attempt to adjust the factors which govern the sources of financing. This will have to be accomplished in face of the lessening of stream flow for dillution purposes, demands for higher water quality, and the resultant requirement for

Photo by A. M. Byers Co.

CHARLOTTE, N. C. put in operation two plants, one a combination trickling filter activated sludge plant.

Photos by Bucyrus Erie and Catterpillar

SEWER CONSTRUCTION: (above) a "Dragshovel" cutting through limestone and basalt rock at Palos Verdes, Calif.; (below) a Catterpillar "Traxcavator" backfilling.

more complete treatment of wastes.

Added to this will be a requirement to join in with the effort on conservation of resources. The maintenance of water quality will not be enough. There will be demands related to the water quantity situation—recharge of the diminishing ground water and development of practical schemes for direct reuse of plant effluents. And, reclamation of the organic material for soil improvement or animal feeding will require attention.

It is not the primary purpose of the present discussion to answer the questions; rather they are suggested as a backdrop for this review of recent trends and developments, with the hope that their consideration in light of experience may lead to sound guide lines for the future.

Federal Legislation

The passage of the permanent and strengthened Federal Water Pollution Control Act (Public Law 660) by the 84th Congress should prove to be a milestone. The Honorable John A. Blatnik, Chairman of the Sub-Committee on Rivers and Harbors of the Committee on Public Works of the House of Representatives is to be accorded the highest commendation for spearheading the movement of this Bill through the Congress. His thorough understanding of the problems, and his ability to make a forthright presentation of the facts brought the support necessary to passage of the Bill.

In the course of the hearings on the Bill there was very encouraging evidence that water pollution control is becoming more fully recognized as a vital part of the solution of this na-

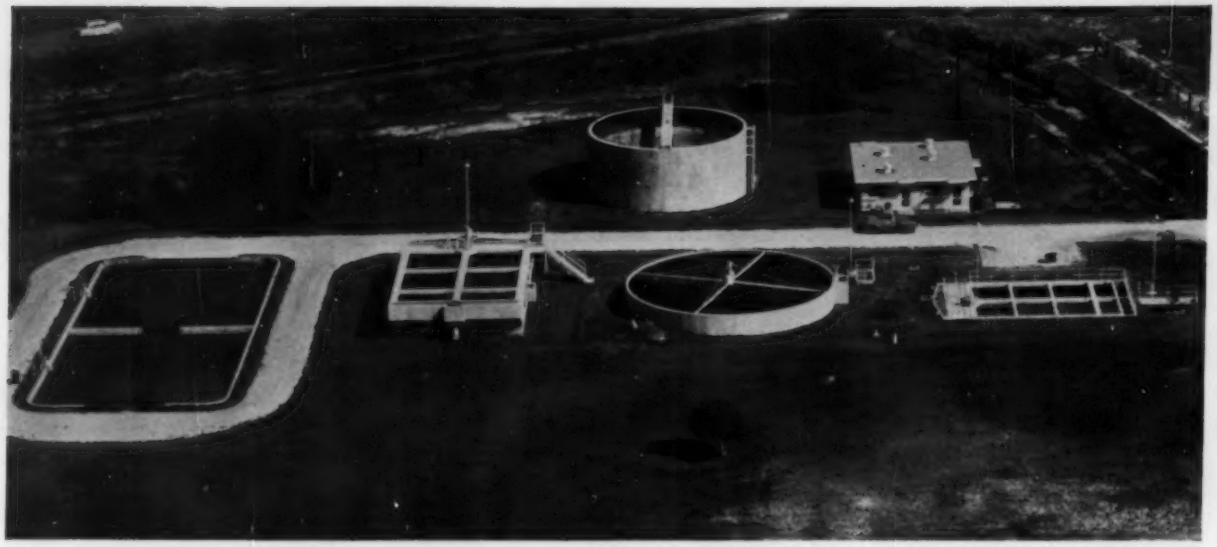


Photo by American Well Works

KISSIMMEE, FLA. presents a "study in baby-blue" which is the color of its new treatment plant.
The public liked the effect; could smell nothing bad.

tion's *total* water resources problem. This problem was stated as being—"Providing the right quantity of the right quality at places where it is needed." And pollution was identified as a "waste of water".

State and interstate agency protests over direct intervention of the Surgeon General of the U. S. Public Service for enforcement, as provided in the initial draft of the Bill, resulted in considerable change. The law now provides that state or interstate action to abate pollution shall not be displaced by federal enforcement except pursuant to court order. However, the Surgeon General is authorized to formally notify state agencies of certain conditions, call conferences, make recommendations, call formal hearings and initiate court action upon request or with the consent of the states involved.

The provisions relating to grants for construction stirred up controversy in the hearings. The proponents claimed that successful pollution control depended upon: research and education, enforcement, and construction; and that the latter (construction) could not be fully realized without grants. They pointed to the fact that the only time in history that cities and towns have kept pace with the demands for sewage treatment facilities was in the era of grants in aid for public works programs in the 1930s. The opponents claimed that the limitations relating to the grant could result in a deterrent to the rate of construction. The law authorized grants for construction of municipal treatment plants in the amount of $500,000,000, during a 10 year period, with

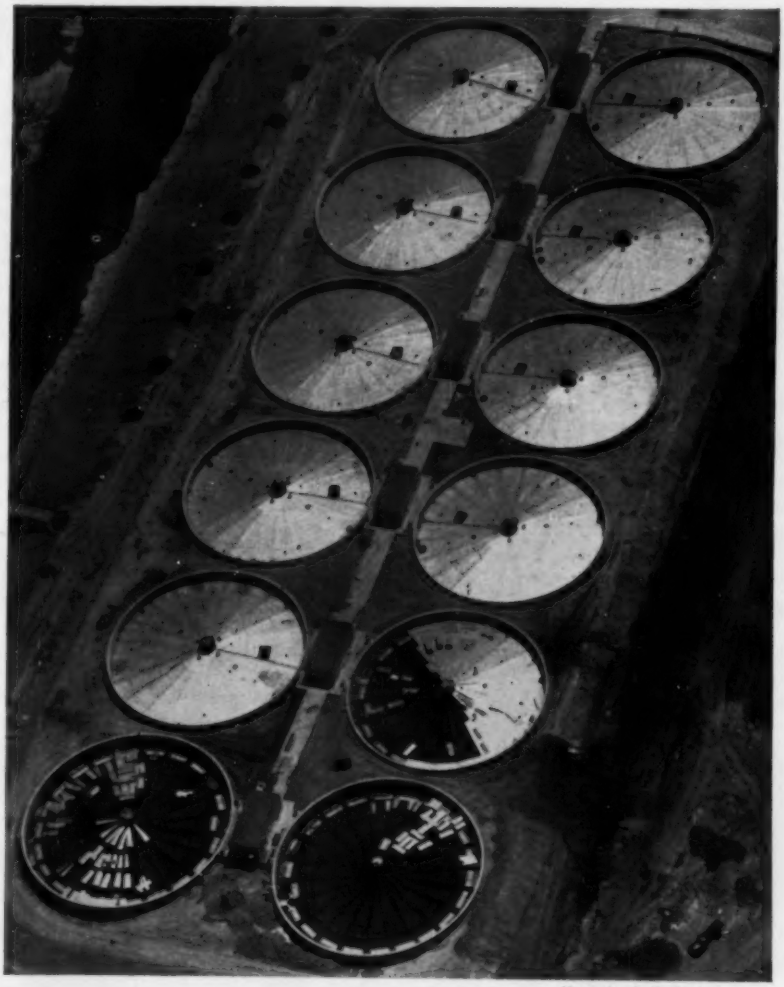


Photo by P. F. T. of Chicago

CINCINNATI'S Mill Creek plant with 12 (110' di.) aluminum floating cover sludge digesters, equipped for the "Pearth" process (gas recirculation) for scum control.

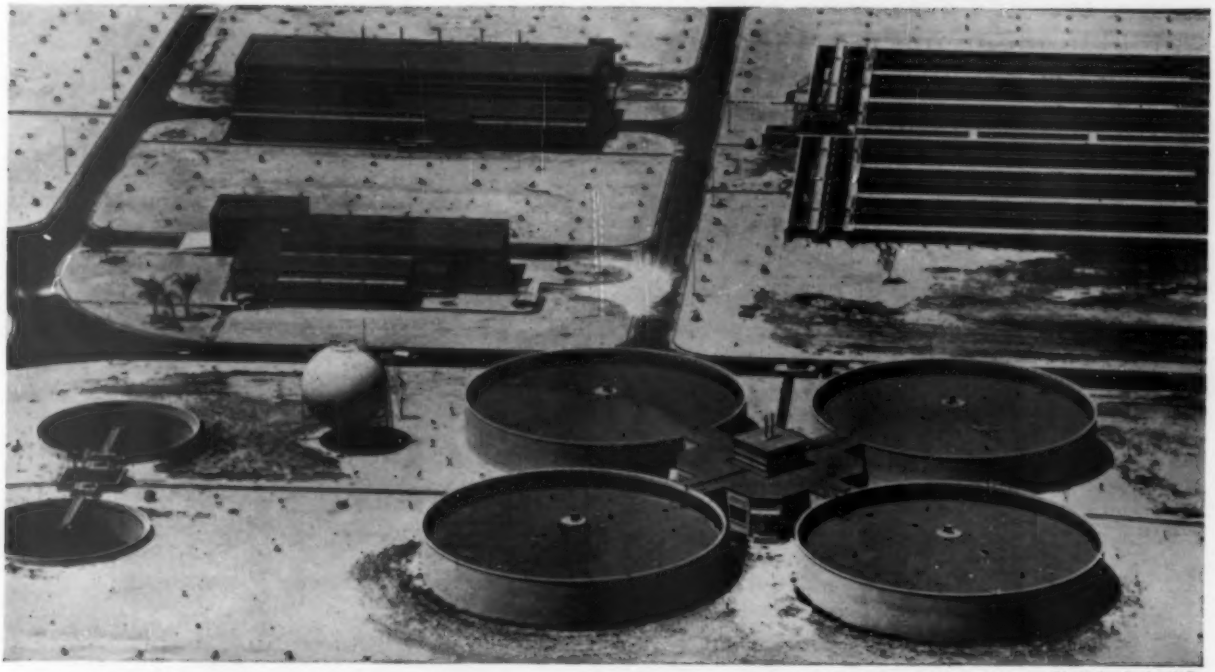


Photo by Preload Co.

MIAMI, FLA'S. new activated sludge plant, nearing completion, has prestressed concrete digesters.

an appropriation of $50,000,000 for the first year. Some slowdown in construction has been reported, due to the time required to set up the machinery for making the grants and the tendency for communities to wait in line for their turn on the priority list. With the intensified efforts on pollution control through strengthened state programs there will appear more and more situations of real inability for communities to handle the financing totally on their own. In this respect the availability of Federal aid may prove to be a key factor in getting the job done.

Considerable interest has developed and action taken toward asking Congress to increase the appropriation from $50,000,000 to $100,000,000 for construction grants in the coming year.

The authorization of $3,000,000 per year for five years for alocation to the state and interstate agencies for pollution control activities should prove to be a key feature of the law. Maximum strength in the program at this level of government is imperative to not only assume the most effective enforcement but to determine upon research needs and to promote necessary adjustments in state legislation.

It was discouraging to note that funds were not appropriated to implement a section relating to research and training. Additional research is the key to providing the resources, especially those for tackling the increasing complexity of the problem. The stage is set to move ahead most effectively—the law is very comprehensive and has considerable latitude with respect to arrangements for research and training, and there is evidence of much interest on the part of the groups who would participate. The next move is up to Congress.

The Federal law (P.L. 660), regardless of its notable features, should not be considered as more than a key to the door. The states now have been provided with some very important tools—financial assistance to their programs, construction grants to deserving municipalities, and a potential production line for research and training of manpower. It is up to the state authorities to make it work.

Process Improvement

A study of sewage treatment operations indicates that, even at this late date, sewage treatment remains more of an art than a science. In recent years research has begun the job of unravelling the mysteries of our well-known treatment units. In the continuation of this activity lies a great potential for defeating the price spiral.

The mysteries of the biological process continue to intrigue investigators. Pasveer[1], through research into air absorption by water, points to small air bubbles having higher efficiency; and rapid circulation in an activated sludge tank as being detrimental to ozygen passing into solution. Hay and Bannister[2] discuss air flotation studies at Racine, Wisconsin, which reveal that 50 to 60 per cent solids removal can be attained over a wide range of conditions; and that the attendant increase in operating costs is more than off-set by the savings in construction.

Pearman[3] describes that by the addition of nitrogen and phosphorous as nutrients, the activated sludge process has been successfully adapted for a kraft mill waste in a large plant at Covington, Virginia. Remaining problems include the removal of color, and elimination of the foam producing characteristics of the plant effluent.

And Baker and Weston[24] proved that petroleum wastes were treatable by the activated sludge process, but better conditioning of the influent is required and dissolved air flotation should be investigated to replace final sedimentation.

The relation between protozoa and activated sludge has been investigated by McKinney and Gram[4]. They show that knowledge of the various protozoa and their significance can be most helpful in operation, that they can be quickly observed, and that they serve as good indicator of the presence of toxic industrial wastes. Methods for the control of foaming in the units were achieved by Wooten[5] in his plant at Carbondale, Illinois. An excellent rational approach to the entire design problem of activated sludge plants was presented by Hazeltine[6] in this magazine.

Oxidation kinetics in activated sludge of trickling filter humus was investigated by Eckenfelder[7]. He indicates the effect of the varying

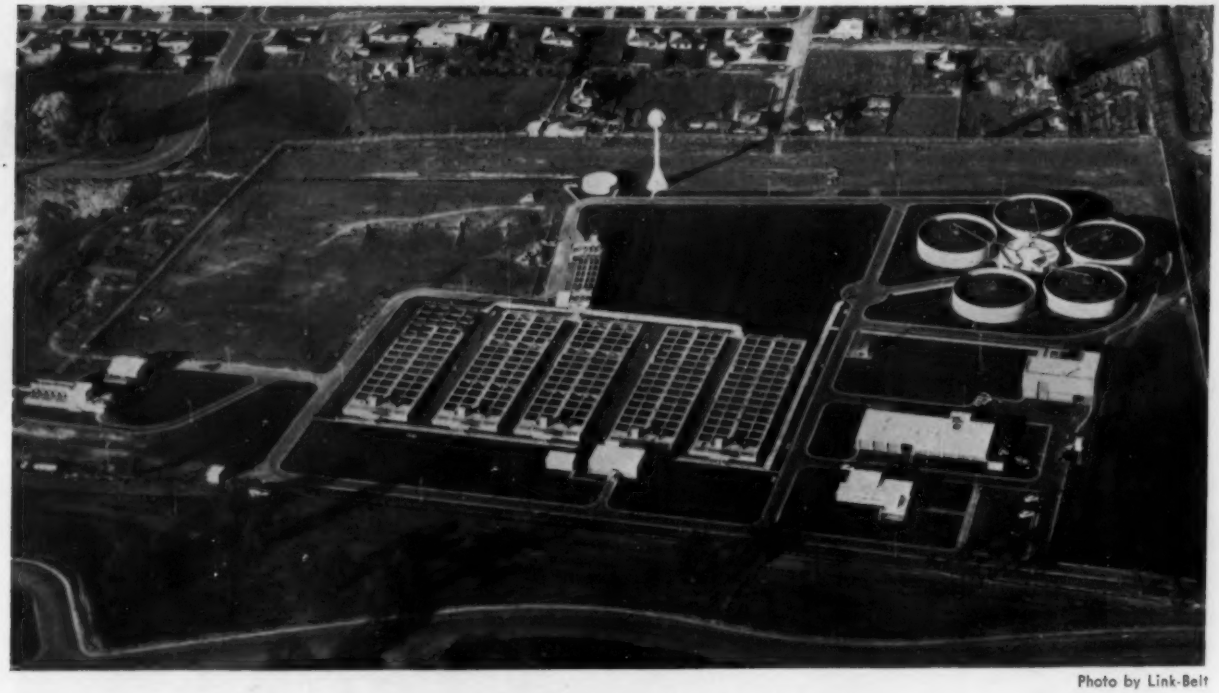


Photo by Link-Belt

SACRAMENTO'S (Calif.) new activated sludge plant.
Note the "Hortonsphere" water storage tank in rear.

content of microorganisms in the waste. The oxidation rate is monomulecular during early oxidation stages but decreases as aeration time increases.

Sludge digestion research centers largely on the high rate processes which have become popular in the last few years. These units operate without loss in stabilization efficiency, but with some loss in efficiency of digestion of saponifiable greases. The reduced volumes give promise that operation in the thermophyllic range is a practical possibility. Sludge thickening devices become increasingly important with this trend. Research into gas collection and utilization continues. The health problem in the utilization of sludge from this process needs careful evaluation.

pH, alkalinity and volatile acids have all been widely used as control tests for digesters. The lack of satisfaction with any and all of these tests has stemmed from a lack of understanding of the nature of the process. Recent studies indicate the interrelationship between these constituents and the relationship of all to digester loadings.

Mau[8] presents a method for the application of recent research to digester design. Indications are that these designs produce better units without materially increasing costs. The main emphasis is on making the entire volume of the digesters useable.

Experience with garbage grinders installed universally throughout Jasper, Indiana five years ago is presented by Frank Wraight[9]. More air was required in the activated sludge units, gas production increased as much as 80%, and there was some deposition in the sewer system, however it was flushed out during peak flows. Baumann[10] discusses the necessity of a uniform particle-size distribution code for household garbage grinders. The objective is to preclude settlement of solids in the sewers and to permit maximum removal in the primary sedimentation processes at the treatment plant.

Commendable foresight is indicated by the following notations on reports and plans relating to the site and treatment units for two large projects: "Reserved for some future treatment procedure now unknown;" and "Possible development in sewage treatment and disposal methods may be such by 1980, that structures and equipment not now contemplated will better meet the conditions at the time. Additions should be designed in light of operating experience, river conditions, and future developments in the art of sewage treatment."

Progress in Construction

Many large cities launched long-range projects. Of great interest was the start on the 60 million dollar improvement of the Hyperion plant in Los Angeles. This project has been titled the "Big Switch," because it contemplates change from the existing activated sludge type treatment to a much lesser degree with deep-ocean disposal of effluent and sludge[28]. The project also includes expansion of the plant from 245 to 420 mgd. The ocean outfall is expected to be 6 miles long and discharge in at least a 200 foot depth.

Milwaukee is planning a 44 million dollar improvement including a new plant and 35 miles of interceptor to eliminate raw sewage by-passing to Lake Michigan. Separation of the combined sewers as a means of correcting the problems was estimated to cost over 200 million.

The world's two largest cities have immense projects underway. London County, Great Britian is building a new plant which will serve 71 square miles and 1,600,000 persons. It will employ the activated sludge process, and the sludge facilities will consist of 16 80-foot diameter primary tanks with floating covers and 8 120-foot diameters secondaries.[29]

And New York City undertook 142 million dollars worth of treatment plant construction under stage 2 of its 325 million dollar pollution program. The largest plant will be the 310 mgd Newton Creek Plant.[30]

Rebuilding of Fields Point Plant for Providence is intended to be a key project in cleaning up Narragansett Bay. It will be enlarged to handle peaks of 160 mgd; and step aeration

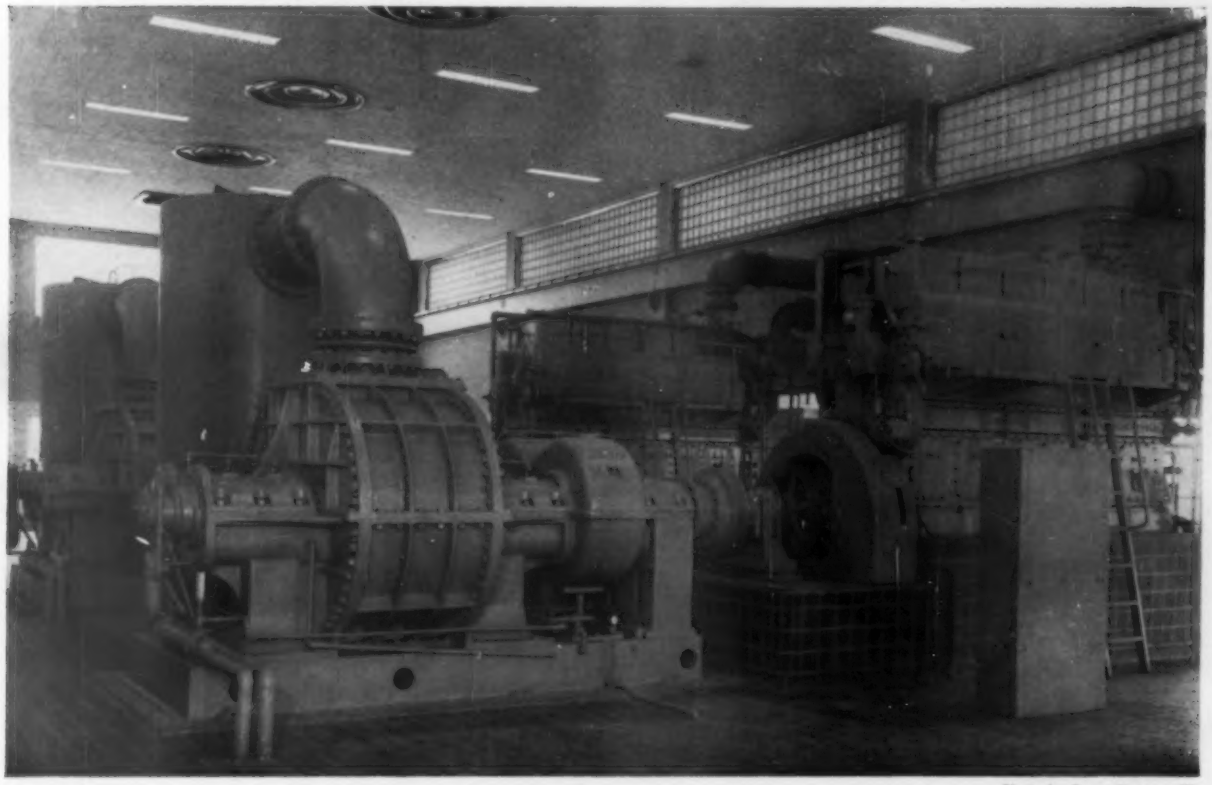


Photo by Roots-Connersville

SOUTH BEND, Ind. started its new plant in 1956.
Worthington dual-fuel engines drive Connersville Blowers.

and "biosorption" will be added to the existing activated sludge process to ease the handling of tributary industrial wastes.[31]

The Sanitary District for the metropolitan area of Tucson, Arizona, which has one of the highest rates of growth in the United States, has done an outstanding job in bringing sewer service to subdivisions and industrial developments. The District now serves over 70 square miles, and the central city, Tucson, accounts for only 5 of this. The commendable feature has been their ability to keep pace with continuous annexations.[32]

South Bend, Indiana, provided some much needed relief to pollution of the beautiful St. Joseph River. Their 48 m.g. plant is the second largest in Indiana. It is designed to give primary treatment to all the flow and secondary by activated sludge process to 50 to 60%. Its cost, including interceptor, was over $10 million.[33]

Stabilization Lagoons

The use of stabilization lagoons as an acceptable method for treatment of raw sewage is now recognized by the states in the Missouri River Basin. This area-wide acceptance tends to take lagoons out of the trial and error stage of development and appears as a significant step in the rather intensive effort to determine the applicability and limitations of this form of treatment. There are 136 lagoon installations in the Basin, 99 of which treat raw sewage and 37 receive primary and secondary effluent.

An extensive study of lagoon installations and operations in the Dakotas[11] reveals: (1) a very high degree of treatment during all seasons of the year; (2) a sufficient reduction in costs to permit small communities to construct sewers and provide treatment which had previously been beyond their means. (3) Odors are present for a short period in the spring following the break-up of the ice and before photosensithis has reestablished aerobic conditions. (4) And, that further research is justified to better define factors controlling purification under different climatic conditions.

Neel & Hopkins[12] report an extremely comprehensive study of raw sewage lagoons in Kearny, Nebraska. The lagoon was constructed under unfavorable soil conditions and with considerably heavier loading than that used in the Dakotas. They report marked coliform reductions during periods of prolific algal growth, BOD reductions equivalent to primary treatment in the winter and equal to secondary in the warmer weather.

Metropolitan Fringe Areas

From the repetitive nature of many discussions of the problem of sewage disposal in the fringe areas of metropolitan centers it appears that the overall characteristics are not changing and that little gain has been made toward a solution. The situation presents a maximum challenge to technical, financial and political interests. It involves new factors in the design of treatment works, and long-range planning for eventual integration of the system with others in the area; usually a high risk for the bond buyers because of the uncertainties of the development; and enabling legislation which usually comes in for consideration along with a myriad of other proposals relating to services in the metropolitan fringe area.

The trend to the installation of central sewer systems in subdivision developments is important not only to eliminate the hazard of the individual septic tank system, but to attaining the ultimate improvement. It eliminates a very potential deterring economic factor with the property owner. Having made an initial investment in

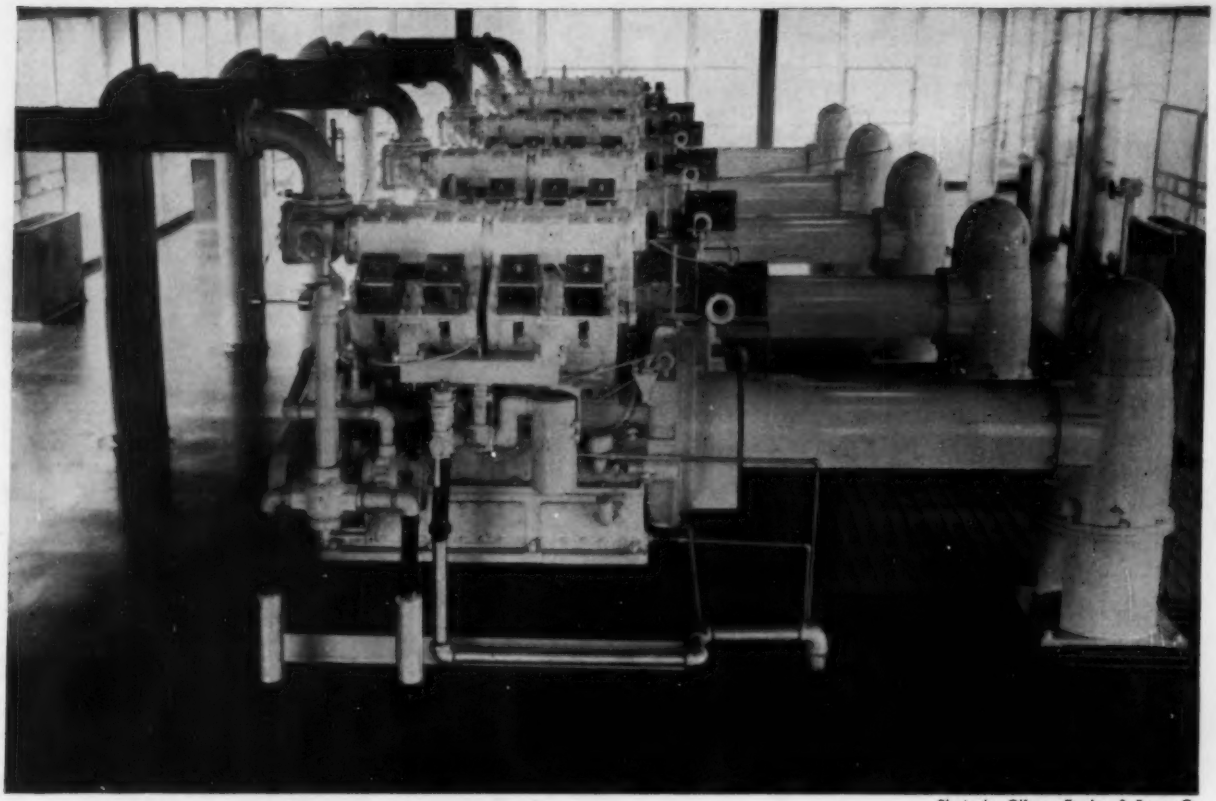


Photo by Climax Engine & Pump Co.

EVANSVILLE, Ind. installs Climax gas engines to drive Worthington vertical pumps through right angle gears.

a septic tank system he would be highly resistant to approve subsequent improvements for sewage disposal, especially when it will usually work out to be a two-stage development.

Another encouraging trend is the recognition and emphasis being given to long-range planning and to the necessity for eventual integration of all systems in a drainage basin or metropolitan area. This is difficult to obtain because necessary resources are usually lacking. Enactment of legislative authority should follow the conduct of engineering and economic studies, yet these studies are precluded by the lack of methods for financing. Joint investigations by political entities involved under existing authority have at times been the answer. These have included a combination of city, county, and state government. In other instances the pollution control agencies have made preliminary engineering studies and published reports, or adopted area-wide policies or requirements which have been fairly meager but sufficient to get the ball rolling. And interim legislative committees have proven effective in studying the problem and in development of necessary legislation.

Statistics from household appliance firms indicate that the inadequacy of septic tank systems will become more of a problem. Based on sales trends, the saturation of automatic washing machines will increase from 50% to better than 90% in the next five years; dishwashers from 20% to 50% in the next two to three years, and garbage grinders from 6% to 35% in the next 4 to 5 years. And, with the garbage grinders, the bulk of the installations are in new developments.

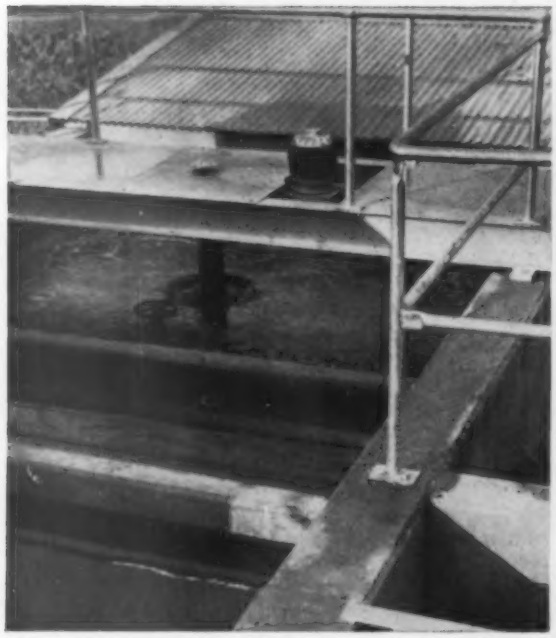
There is a definite need for more development work on treatment facilities suitable to the requirements of the small systems in the fringe areas. Their characteristics include simplicity of operation, a maximum of salvage value and flexibility with respect to additions. Coulter and others[25] present findings of a pilot plant study of such a facility, employing sludge contact followed by filtration trough a submerged rock column. Solids removal was high but BOD removal was mediocre. Plain sedimentation followed by disposal through a sprinkler irrigation system has been used successfully. And a system using essentially excessive aeration as the means of treatment is proving satisfactory in many locations.

A significant court action relating to this problem occurred in Marple Township, Pennsylvania. The Township, by ordinance requires subdividers to furnish septic tanks and also sewers, or connections to trunk lines, which the township would construct at a later date. A builder contested, and in the court action including a review by the U. S. Supreme Court it was held in essence that the requirement was reasonable and within the discretion invested in the Board of Supervisors.

There is evidence that the larger, more stabilized, areas should not adopt a feeling of complacency, assuming that they can absorb the mushrooming growth in stride. Situations have developed wherein the job was not as simple as extensions of the system, consolidation of areas, and expansion and refinement of treatment. Just due to sheer size the overall sheme of handling had to be radically changed, especially with respect to disposal of effluents. Continued use of adjacent water courses became prohibitive. The improvements may involve greater financial, political, and engineering problems than ever encountered heretofore.

Industrial Wastes

Activity in the industrial waste field continues to be a major factor in water pollution control. A great deal of interest in pretreatment and prevention of wastes continues. The account of an Industrial Wastes Fo-



Photos by Yeomans and Wash. Al. Co.

"CAVITATOR" in activated sludge plant at Shoals, Ind. and (right) safety-first aluminum gratings, and railings at Clinton, Mass. The bar screen and gates are also aluminum.

rum[13] gives a detailed discussion of this problem. One readily observes that the type, volume, and strength, of these wastes vary so tremendously as to make any general summary impossible. Pretreatment and curtailment may take many forms, such as (1) separation of waste streams; (2) recirculation of cooling water; (3) use of effluent from one process in a second process; (4) equalization and neutralization of wastes; (5) by-product production; (6) save-alls; (7) process changes. All have their place, with the solution in many instances being a matter for the industrial process engineer rather than the sanitary engineer.

Planning enters the picture as we see increased attention to waste disposal possibilities as a factor in plant location. Watson and others[14] report a very interesting discussion of several facets of this problem although it obviously omits many basic factors, which led to the assumptions upon which the presentations were made. This is going to be a most important consideration in connection with atomic energy plants. There has been an unprecedented thoroughness in the site selection studies by the Atomic Energy Commission, its contractors, and licensees, for these installations. These might well be useful as a guide for other industrial installations.

Anerobic digestion has been demonstrated to be a successful means of treament for troublesome wastes. Steffen[15] discusses application to meat packing wastes; and Dunstan[16] to pea blancher wastes. The greatly reduced costs of these treatments compared to conventional aerobic processes focuses more than ordinary interest upon the anaerobic methods. The combination of these advantages with the use of high rate digestion may, in the opinion of many revolutionize sewage treatment processes in the forseeable future.

Adequate methods for treatment of the great variety of industrial wastes appears to be the major problem. Practical and economic methods for many wastes are unknown and cannot be determined because of lack of knowledge of waste characteristics. Especially perplexing are wastes including synthetic organic chemicals. Modifications of existing processes do not appear to be the whole solution. Hess[17] notes that extensive research applying knowledge of colloids, enzymes, supersonics, nuclear energy and radioactive tracers might result in great improvement. The discharge of industrial wastes to municipal treatment plants will always have its limitations. Primary purpose of the municipal plant must be recognized and certain wastes are not amenable to treatment by domestic sewage treatment process and can be more economically treated at separate plants.

Additional states have inaugurated a permit system for controlling industrial wastes discharges. This has been reported as very satisfactory by the agencies in providing an inventory of pollution loads and as a means of controlling *new* industrial wastes discharges. The definition "new" includes any increase in volume or strength of existing wastes.

Research

Considerably more attention is being given to the role of research—a recognition that in many respects it is a starting point, and will provide the key to the solution. It is a recognition of the fact that the old way of doing things may not be the right way. This is research in its broadest sense, and in all its detail—involving not only performance, but vigilant application of what is known and what is to be developed. The significance and bearing of research is aptly stated by Hess[17] who states—"It might appear that an incredible amount of research is needed, but if not carried out the cost of the misdirected pollution control could be incomparably higher, economically and socially. Ample and wisely directed research can serve to provide lighted guideposts along the road to pollution control which would enable us to reach our destination without wasting our resources frequently by going in circles in the darkness."

Increased attention to research is stemming from the fact that research to date has exposed the vast extent of the unknown; and the tightening economic situation which dictates the need to get at all the fundamentals involved.

Those responsible for leadership in research are unified in their analysis

Photo by Nat'l. Power Rodding Co.

SEWER CLEANING by contract at night in Chicago's busy Loop district. The "tree" growing through this 54" sewer (right) is actually a tree root which entered at the top.

of the need. What remains to be done is to give them support to put the wheels in motion. It will require a cooperative and maximum effort of all scientists and technologists in industry and research institutions. The U. S. Public Health Service can be of tremendous assistance under its authority, granted by the new Federal Water Pollution Control Law (PL-660) if Congress will appropriate the funds.

Hess[17] has presented the research needs and challenges in a very logical and inclusive manner. In the area of science of water he discusses what needs to be known before we can safely utilize the maximum self-purification or assimilation ability of receiving streams. With regard to water quality or the basis for treatment requirement there is controversy over values having critical bearing on treatment costs and much is not understood concerning the effect of synergisms and antagonism. Development of reliable indices of water quality related to its uses is essential to economic design of treatment, and should tend to iron out the current variance in allowable values.

In a third category Hess urges research in methods for waste control. In industry, development of production processes which will minimize amounts of objectionable wastes should be given first consideration; and, in connection with recovery processes the rising costs of treatment indicates that a closer look should be taken at certain potential by-product developments which have heretofore appeared uneconomical. With further study these may provide a less costly solution even in instances where the supply of the product would exceed the demand. New types and increasing complexity of wastes, and the necessity for more complete investigation of water quality indices and assimilation ability of streams will require extensive refinement and development of analytical methods.

Attainment of maximum benefits from atomic energy will depend upon and require extensive research to develop economical methods of radioactive wastes disposal. Finally, Hess[17] notes that the scientists and technologists must also work with legislators, government agencies, and lawyers to lay sound foundations on which to build legal structures and administrative programs.

Garber[18] presents results of a survey of bathing load limits in various states. The extremely wide variation develops question on soundness of the standards, and suggests need for more study. The use of the coliform index as an indicator organism is questionable inasmuch as it is really fresh sewage with which health authorities are primarily concerned. Orlob[19] discusses the viability of sewage bacteria in sea water, pointing out the effects of sedimentation, temperature and other factors, and formulating an equation for the decrease phase and aftergrowth.

Lieber[20] discusses efforts to dispose of effluent under ground and the chemical poisoning which has occurred from such practice. Technical problems in disposal of petrochemical wastes by ship transportation to deep ocean waters are outlined by Eberman[21].

Another approach to this whole problem is outlined in an article by Tarzwell.[22] The widely ranging nature of water pollutants, each with a slightly different effect on stream biota, has led researchers into a search for indicator organisms which would be sensitive to *all* wastes; and would, therefore, reflect the overall effect of a waste discharge. The paper seems to indicate that while facts such as flow and temperature variations are very important, one can get an indication of degree of contamination from the distribution and number of species present. The occurrence of a single species in a particular locality has little or no significance.

Ettinger[23] has called attention to the fact that stream polluting organic chemicals fall into two groups—those rapidly destroyed in streams and those that persist for varying periods of time, some indefinitely. Potential damage to streams by chemicals of the second type are not subject to analysis by BOD and DO tests. They have caused taste and odor difficulties, coagulation problems, high chlorine demand, and toxic effects to aquatic life. There is a wide range in their resistance to biochemical attack. Extensive research is required to develop related water quality indices and methods for treatment of these wastes.

The technical and economical aspects of sewage and sludge disposal

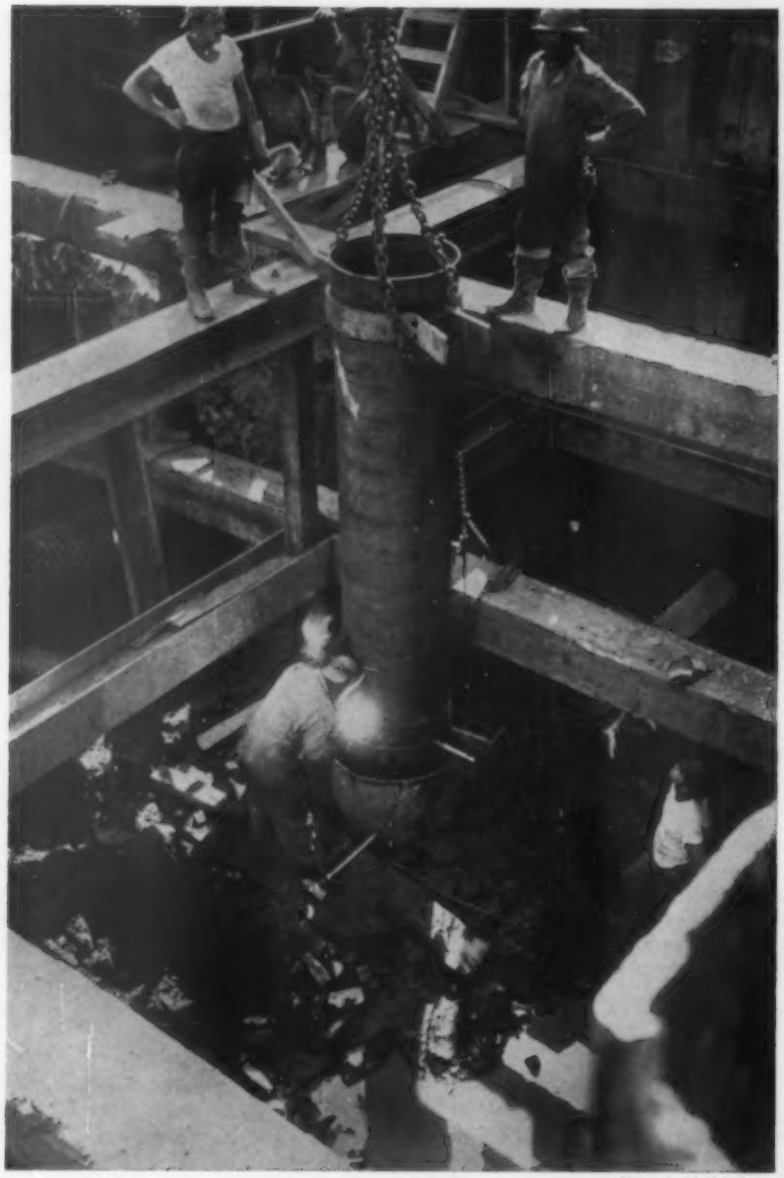


Photo by A. M. Byers

UNUSUAL is this 25" wrought iron 70' drop shaft, of which there are several, in Alleghany County Authority's 80 million dollar sewerage improvement program.

through submarine outfalls was very thoroughly studied by Pearson[27] in connection with the projected long outfall deep water disposal of sewage and digested sludge from the enlarged Los Angeles treatment plant. This is most significant, because of the extensive use of submarine outfalls by coastal cities and the fact that they are generally considered in connection with the required degree of treatment. It is important to have a thorough understanding of the possible effects of submarine discharges on water quality and adjacent beneficial water uses, and the relationship of design factors to these effects. With this information the assimilation ability of the water course can be used to a maximum and treatment costs kept to minimum.

Pollution and Water Resources

There is evidence that many states are giving concerted attention to their water resources problem through various boards and study groups. It is certain that these activities will have a profound bearing on pollution control. As more realization develops that water supply quality is as important as quantity, and that there is a potential within waste treatment practices with respect to quantity, then pollution control interests will gain an important ally in promoting their objectives. The product to sell, then, becomes one of water or water resources, not the rather unpopular item of sewage treatment.

The involvement with water resources picture is not all a favorable one. Pollution control finds itself in competition with increased water demands for many uses and therefore less water for dilution and assimilation of treatment plant effluent.

In a few cases pollution control has been set forth in the list of potential benefits expected from specific water resource developments. However, it appears that with some of these such was done as an afterthought to gain just a little more support for the main purpose of the project, and not in light of the real value. This situation presents a real challenge. Benefits accruing from pollution control measures must be put on a dollar and cents basis, and presented in conjunction with the other factors such that they will be given rightful recognition.

The reuse of conservation of waste waters is becoming well established. The pulp and paper industry has been active in this field. One steel mill reports that through recycling, their water usage is less than 2% of the generally accepted figure. Naturally these measures are most practiced in the water short areas of the Southwest.

The use of effluents in irrigation is becoming widespread. This is particularly applicable in the vegetable and fruit canning industries where greatest water uses are in the growing season. Its development is not without its problems. Odors and biological growth have often become serious nuisance sources.

Many areas have adopted water spreading and sub-surface discharge as a means of reducing pollution of streams. The inherent health hazards continue to cause concern in areas where the ground water is a source of domestic supply. Research must continue into the removal of bacteria by passage through soils. Welsch[20] relates a case involving contamination of ground water by cadium, and Neel and Hopkins[12] report similar action by detergents in their lagoon studies.

Costs and Financing

Many complain of the spiraling costs of pollution control works. Besides the established factors of higher wages and material prices and the rapidly increasing bond interest rates, mention is often made of the stringent design standards and water quality

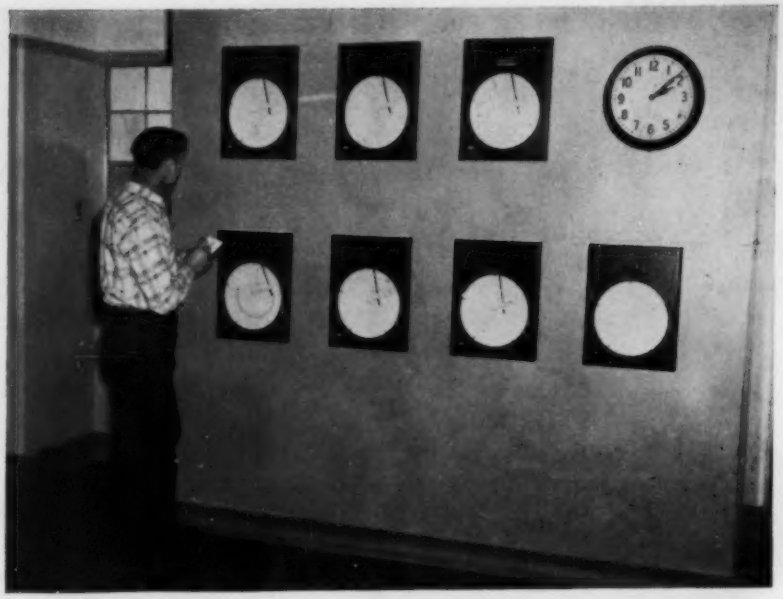
criteria in force in many states. It is contended that they deter modern developments in operational procedures and improvements in design and materials of construction.

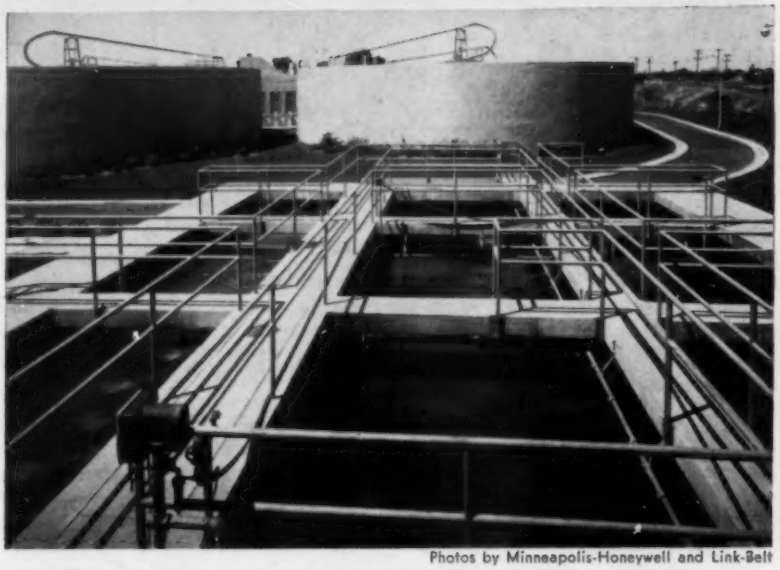
What can be done about this latter factor? First, we must realize that through interstate agencies several attempts have been made to standardize on criteria. Much progress has been made, and perhaps more is needed. One must also realize that these criteria and standards are a state function and that each state is privileged to finally decide what standards are justified, what gains will be achieved, and the additional cost involved in obtaining these requirements; and that the pressure of conservationists to maintain the high standards is frequently insurmountable. It is not a situation within full control of state agencies. Research and demonstrations and a most realistic attitude on the part of all involved will gradually reduce the influence of this factor.

The higher costs present a real challenge to the practicing engineer. He must constantly reevaluate his designs on the basis of ever-changing economic factors; he must bear in mind the cost of operating the facility, realizing that maintenance expenses are constantly rising, and that on the other hand better operators will surely insure lower maintenance costs.

What can be done to reduce costs? Many cities are falling back on stage construction—a primary plant today, with plans to add secondary units at a later date; an intermittent and filter which will be converted to a sludge bed, and an Imhoff tank will become a digester. Smaller cities have installed sewer systems with lagoons for treatment, and plans are made to replace the lagoon with a plant as the sewers are paid off and as increased population demands additional facilities. We find engineers reducing the design period to as little as five years, with adequate provision for addition to the proposed unit.

Financing methods are under constant study. In addition to the usual method of general obligation bonds, service charges, front-foot assessments, and connection charges, we find many rapidly growing cities which are requiring developers to furnish all utility lines, built to acceptable standards, when the property is developed. Lease-purchase arrangement, which is becoming somewhat common in financing other municipal enterprises may be an adaptable solution. There is a general feeling that the problem is not so much one of higher cost as it is in providing equitable methods of paying the bill.





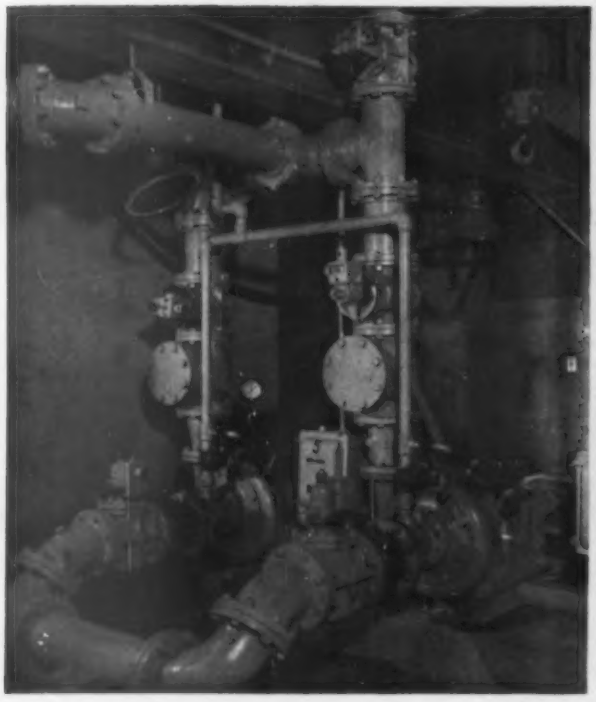
Photos by Minneapolis-Honeywell and Link-Belt

INSTRUMENT panel at Austin, Texas', "Bioserption" activated sludge plant. (Below) Sludge elutriation system at Sacramento's new treatment plant.

Another important consideration in the total financing picture revolves around the creation on the part of the public of a desire for pollution control or a willingness to pay for the improvements. This is largely an educational problem. Costs have risen as sharply in other fields as in waste treatment, yet business indicates that spending has increased in like proportion. This is due to increased efforts to promote an improved standard of living. Since typical commercial approaches are not always available to pollution control agencies, the challenge is even greater. In this effect all those in the field must play a part, for all have a stake.

Legal Aspects

Clear-cut examples of trends with respect to the rights and privileges of cities or industries who would cause pollution conditions and the control allowed to the court and administrative agencies are given in an excellent paper by Resh[26]. He claims that no area of social control is more susceptible or subject to the exercise of a state police power than that of water pollution control. He cited court decisions which said in part: "The state may in the exercise of its police power require that sewage be purified before being passed into a stream or it may absolutely prohibit the use of streams for such purpose."



Photos by DeZurick Corp. and Komline-Sanderson Co.

PLUG VALVES of non-lubricated type in San Francisco's S. E. plant and coil-filter dewatering undigested sludge at Perryville, Mo.

The municipal corporation has no immunities under the constitution which it may invoke against the state, and the authority of the legislature is supreme. The city is liable for the maintenance of a nuisance, even when operating in its governmental capacity. The courts are tending to award for damages rather than grant injunctive relief. It appears this is based on a theory that there should be a balancing of the equities. The harm to the few who are being injured is weighed against the harm to the entire community affected by the injunction procedure.

Cities having accepted connection of an industrial plant to its sewer system take on the responsibility for the treatment of such wastes and must stand the consequences of pollution resulting from any deficiency of treatment. However it is not incumbent upon the city to permit the connection in the first place. In cases of claims for damages to riparian interests there is a trend to requiring that there be substantial injury, and more emphasis is being placed on the matter of proof of injury.

It was interesting to note that at times conflicts arise between the court and the administrative agencies. The fact that a Sanitary Water Board had approved and authorized a treatment plant installation was not recognized by the Court and relief was granted. In general there is an increasing awareness and sensitivity to the problem by the Courts and the legislatures.

Size of Job Ahead

An indication of the increase in quantity of waste and complexity of the treatment and disposal problem is given by the prediction that 90% of the population increase until 1975, or 37 million people, will locate in communities or urban areas; and that water supply consumption will increase from 15 to 25 billion gallons per day for domestic use, and from 60 to 130 for industrial use. Meeting the needs of this growth will represent only 40% of the expected 22 billion dollars worth of construction in the next 20 years. To eliminate present deficiencies and off-set obsolesence and depreciation will require about 14 billion dollars, or the other 60%. This task must be accomplished in the face of rising costs and a considerable lack of know-how. Past records reveal that the job will get done, but it is certain that it will require more cooperation, alertness and effort.

Federation Affairs

The Federation of Sewage and Industrial Wastes Association paid tribute to Dr. Karl Imhoff on his 80th birthday, April 7, 1956. He was presented with a plaque carrying an inscription which recognized his tremendous contributions to improvement of waterway sanitation.

The Federation, now with more than 7000 members, held its Annual Meeting in Los Angeles, October 8-11, in conjunction with the California Association. W. H. Wisely, former Executive Secretary, was awarded a well deserved "Honorary Membership". Substantial revision of the Constitution and Bylaws broadened and strengthened the committee structure and allows the large member Associations to elect two directors.

Milwaukee was selected as the location for the 1961 Annual Meeting. Other locations include Boston 1957, Detroit 1958, Dallas 1959, and Philadelphia 1960.

A concerted effort is being made by the Industrial Wastes Committee to strengthen the activities of the Federation in the industrial wastes field; and to create interest of industrial representatives.

A special committee has been established to determine ways and means of extending the membership and programs of the Federation and of increasing the value of its member Associations to the small plant operators.

Acknowledgment

The author wishes here to express to the several consulting engineers, and to the U. S. Public Health Service engineers, his appreciation for their views supplied in connection with the preparation of this review. Epecially does he wish to give credit

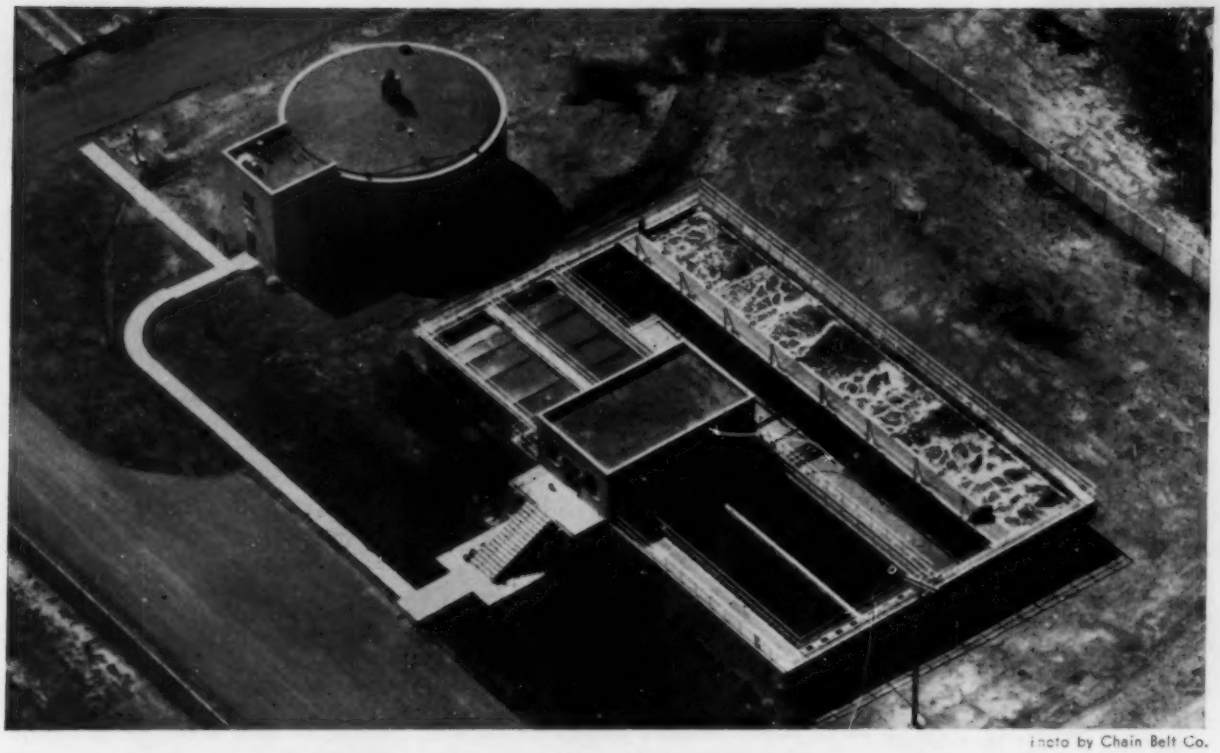


Photo by Chain Belt Co.

SHELBYVILLE, Tenn.'s compact and efficient new activated sludge plant.

to Roger James, District Engineer on the writer's staff, for his valued assistance in the development of this review.

References

1. Pasveer, A., "Research on Activated Sludge." Sew. and Ind. Wastes, 28, 28 (Jan. 1956)
2. Hay, T. T., "Air Flotation Studies of Sanitary Sewage." Sew. & Ind. Wastes 28, 100 (Jan. 1956)
3. Pearman, B. V., Jr., 'Largest Nutrient-Fed Activated Sludge Plant for Paper Wastes." Wastes Engr., 27, 494 (Oct., 1956)
4. McKinney, R.E., and Gram A., "Protozoa and Activated Sludge." Sew & Ind. Wastes, 28, 1219 (Oct., 1956)
5. Wooten, J. L., "Activated Sludge Froth Control." Water & Sewage Works, 103, 44 (Jan.. 1956)
6. Haseltine, T. R., "A Rational Approach to the Design of Activated Sludge Plants." Water & Sew. Works, 102, 487 (Nov. 1955)
7. Eckenfelder, W. W., Jr., "Studies on the Oxidation Kinetics of Biological Sludges." Sew. & Ind. Wastes 28, 983 (Aug., 1956)
8. Mau, G. E., "Applying Recent Research to Design of Separate Sludge Digesters." Sew. & Ind. Wastes 28, 1199 (Oct. 1956)
9. Wraight, F. D., "Garbage Grinder Experiences, Jasper, Indiana" Sew. & Wastes, 28, 44 (Jan. 1956)
10. Baumann, E. R., Dorman, D. A., and Skodje, M. T.,—"Particle-Size Distribution of Ground Garbage." Sewage & Industrial Wastes 27, 1245 (Nov. 1955)
11. Towne, W. W., Bartsch, A. F. and Davis, W. H., "Ray Sewage Stabilization Lagoons in the Dakotas." Presented at Annual Meeting of FSIWA, Los Angeles, Oct. 8, 1956.
12. Neel, J. D. and Hopkins, G. J., "Experimental Lagooning of Raw Sewage," Sew. & Ind. Wastes, 28, 1327 (Nov., 1956)
13. Brown, J. M. (Leader), "1955 Industrial Wastes Forum." Sew. and Ind. Wastes, 28, 651, (May, 1956)
14. Watson, K. S., and others, "Some Factors in the Location of a New Chemical Plant— A Panel Discussion." Sewage and Ind. Wastes 28, 1247 (Oct., 1956)
15. Steffen, A. J., "Full-Scale Modified Digestion of Meat Packing Wastes." Sew. & Ind. Wastes, 27, 1364 (Dec., 1955)
16. Oliver, G. E. and Dunstan, G. H., "Anaerobic Digestion of Pea-Blancher Waste." Sew. & Ind. Wastes, 27, 1171 (Oct., 1955)
17. Hess, R. W., "Challenge to Research by Water & Air Pollution Problems." Industrial Wastes 1, 273, (Nov.-Dec. 1956)
18. Garber, W. F., "Bacteriological Standards for Bathing Waters." Sew. & Ind. Wastes, 28, 795 (June, 1956)
19. Orlob, G. T., "Viability of Sewage Bacteria in Sea Water." Sew. & Ind. Wastes, 28, 1147 (Sept., 1956)
20. Welsch, W. F. and Lieber, M., "Ground Water Pollution from Industrial Wastes Sew. & Ind. Wastes, 27, 1065 (Sept. 1955)
21. Eberman, J. W., "Disposal of Wastes at Sea." Sew. & Ind. Wastes, 28, 1365 (Nov. 1956)
22. Gaufin, A. R. and Tarzwell, C. M., "Aquatic Macro-Invertebrate Communities as Indicators of Organic Pollution in Lytle Creek." Sew. & Ind. Wastes, 28, 906 (July, 1956).
23. Ettinger, M. D., "Biochemical Oxidation Characteristic of Stream-Pollutant Organics." Ind. & Engr. Chemistry 48, 256 (Feb. 1956)
24. Baker, R. A., & Weston, R. F., "Biological Treatment of Petroleum Wastes." Sew. & Ind. Wastes, 28, 58 (Jan. 1956)
25. Coulter, J. F., Soneda, S. and Ettinger, M. B., "Anerobic Contact Process for Sewage Disposal." Presented at Annual Meeting of FSIWA, Los Angeles, October 8-11, 1956.
26. Resh, W. H., "Court Decisions and Statutory Provisions in Water Pollution Control Law." Sew. & Ind. Wastes 28, 211 (Feb. 1956)
27. Pearson, E. A., "An Investigation on the Efficacy of Submarine Outfall Disposal of Sewage & Sludge." Publication No. 14, State Water Pollution Control Board, Sacramento, California.
28. Engineering News Record, 156, 27 (April 5, 1956)
29. Engineering News Record, 157, 122 (July 5, 1956)
30. Engineering News Record, 157, 25, (Aug. 23, 1956)
31. Engineering News Record, 156, 33, (June 14, 1956)
32. Henry, L. O., "Modern Sewage Facilities for Tucson Metropolitan Area," Water & Sewage Works, 103, 122 (March, 1956)
33. Rehm, L. D., "Interceptor Sewers & New Plant Reclaim a Recreational Area," Wastes Engineering, 27, 507, (Oct. 1956)

Engineered Expansion Program Benefits Atlantis Annexed Areas

To make good the slogan: "Where water goes Atlanta grows"

by PAUL WEIR*

Mr. Weir is General Manager, Atlanta (Ga.) Water Works. His article describes the forward-looking procedures by which Atlanta's progressive water department is planning well into the future.

*Mr. Weir is currently president of the American Water Works Assoc.

MOST growing cities are faced with the problem of development of suburban areas outside their city limits. There are many and varied reasons why people build outside the city limits where water, sewers and other utilities are not available. The principle reason probably is the lack of adequate and desirable building sites within the city boundaries. Additional reasons include the willingness of some people to sacrifice conveniences for lower taxes; the desire of others for rural living; and the availability of large tracts of land for real estate development.

However, for whatever reasons a suburban area may have started, it eventually becomes fairly well built up and the majority of the citizens in the area want water, sewers, gas, police protection, fire protection, traffic control, and the many other advantages that only the well run city can supply. It might be said that they decide that in order to have $1.00 worth of service they must be willing to pay $1.00 worth of taxes. Once the people in the suburban areas have been sold on the idea that they can best obtain the services they want by joining with the city, annexation will follow.

Annexation Triples Land Area

Atlanta, Ga., which is one of the most rapidly growing cities in this country, was faced with this problem. In 1951 the citizens in the larger part of the suburban area of Fulton County voted to join with the City of Atlanta. As a result, the land area of the city was increased by annexation from 37 square miles to 118 square miles on January 1, 1952; on February 1, 1953, an additional area of 9 square miles was annexed (Fig. 1). The annexation increased the land area of the City of Atlanta by 343 per cent. The population within the city limits before annexation was 334,800. The annexation of 1952 added 118,800 people; the 1953 annexation brought in an additional 3,500 people. Annexation on this scale is a major undertaking requiring very careful planning to successfully integrate these newly annexed areas into the city. Atlanta has successfully accomplished this through its Plan of Improvement.

The Atlanta Water Works has successfully carried out its part of the Plan of Improvement program by providing an adequate supply of water for both domestic service and fire protection in all sections of annexed areas and improved service within the former city limits. The success of this program was evident from the start, as it was based on a sound engineered program developed by the Water Works Engineering Department and the consulting firms that are normally employed.

Character of Annexed Areas

The City of Atlanta had not had a program of annexation for a considerable period of time. Consequently, the areas adjacent to the city were built-up to such an extent that one could not tell whether they were in or out of the city boundaries. These built-up areas extended for a distance of approximately three miles north and west of the city and approximately one mile south and southwest of the City.

By far the greatest part of 122,000 people who were annexed lived within these areas and approximately 108,000 had some water service. Mains had been extended into these county areas for a number of years on an assessment basis. Consequently, the main sizes were mostly 6-inch and smaller, with numerous long dead end mains and only a few trunk mains leading into the areas. In many cases the domestic service was barely adequate; in most areas fire protection was totally inadequate. In many parts of these areas numerous complaints were received about low water pressure and during periods of maximum consumption water service was not adequate.

Hydraulic Studies Show Deficiencies

In 1948 the National Board of Fire Underwriters made an inspection. It was evident from their fire flow tests that Atlanta had again outgrown its water distribution system and that it would be necessary to rehabilitate the existing trunk main system and start on another major plan for expansion.

The first step in this rehabilitation and expansion program was to have a survey made by The Pitometer Associates, Inc. to determine the efficiency of the existing system and to obtain data that could be used to establish water quantities for future design. This survey showed that although on the surface the problems appeared to be local, they actually involved large sections of the distribution system and their solution would require extensive improvements in many parts of the distribution system. The principle causes of deficient service within the former city limits were as follows:

1. Lack of trunk main capacity in some areas.

2. Low carrying capacity in the trunk main system.

3. Lack of elevated storage to reduce the loads in the trunk main system during periods of maximum consumption.

Fortunately, through engineering and planning the program for rehabilitation of the Atlanta Water Works was already in action when the extensive areas were annexed under the Plan of Improvement in 1952 and 1953.

When these areas were annexed it became the obligation of the Department of Water Works to supply adequate water for domestic service and fire protection and to develop a program of mains that would allow for future expansion in the annexed areas.

To obtain data and to develop a program for improving service in the annexed areas, the Pitometer studies were extended to cover the areas annexed under the Plan of Improvement. The principle deficiencies in the annexed areas were found to be:

1. Lack of trunk main capacity.
2. Distribution system not developed at fire flow level.
3. Large number of dead end mains.
4. Many areas supplied by 2-inch mains.
5. Lack of valves and hydrants.
6. Large areas with no water supply.

As a starting point for studying these areas, the ward boundaries existing at the time of annexation were used to define the study areas. To determine the water consumption, the wards were divided into Pitometer districts and measurements were made in each district to determine the total amount of water used, the maximum rate of use, and the minimum rate of use.

These water consumption measurements were correlated with population studies to obtain per capita consumption figures from which to estimate future water quantities required. Studies were also made of the amount of water available for fire protection purposes.

Planning Program

Preliminary engineering studies indicated that a minimum of 215 miles of main of various sizes would have to be laid to provide adequate water service and to water the areas not supplied. It was evident that such a program would require several years for completion. It was also evident that the work would have to be classified and placed in some definite program if this large volume of work was to be completed in an orderly manner and maximum benefits derived from the mains installed.

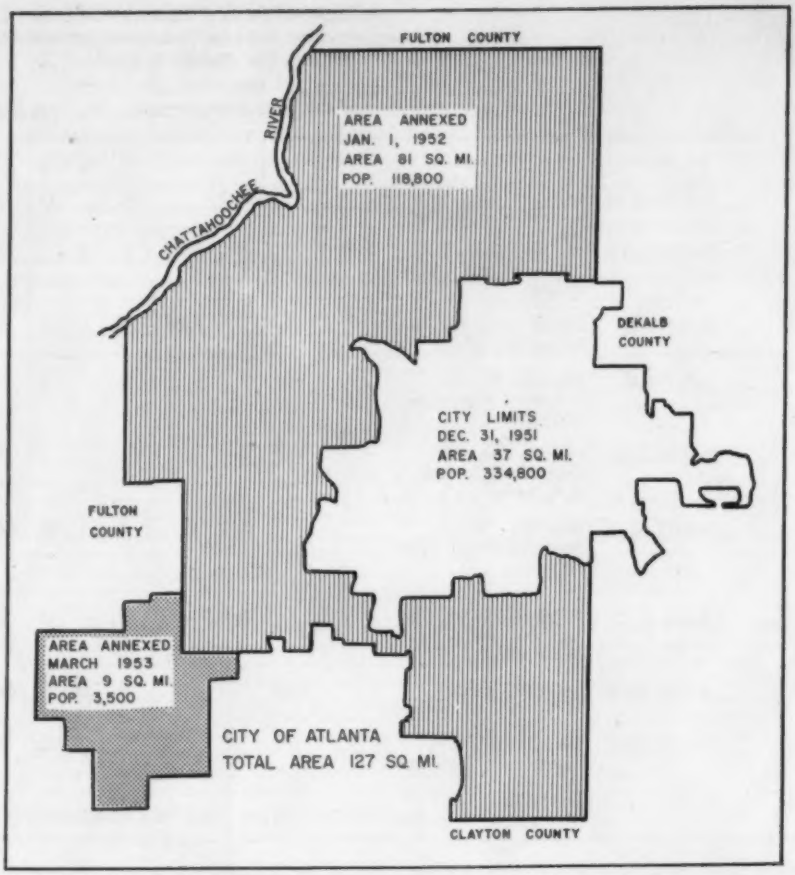


Fig. 1—AREAS annexed by Atlanta, Ga., under the City's Plan of Improvement.

It was decided to classify the work into seven categories, as follows:

1. Elimination of existing dead ends.
2. Installation of additional fire hydrants in existing system.
3. Installation of additional valves in existing system.
4. Replacement of existing 4-inch and smaller mains.
5. Installations of new supply mains (12-inch and larger).
6. Installation of new distribution mains (under 12-inch).
7. Installation of connections between existing parallel mains.

Maps of the existing system were studied and field checks made of the streets. The streets where new mains or improvements were needed to provide adequate water service, were listed in the proper category. Each street was assigned a number and the following information listed: the name of the street, the location of the proposed main, the number of houses, whether watered or unwatered, the size and length of pipe required.

Two 5-Year Programs

It was estimated that it would require approximately five years to make the necessary improvements to the distribution system in the annexed areas. The engineers also estimated it would require approximately five years to make the necessary capital improvements to adequately supply the expanded system. Some of the required capital improvements included installation of two miles of 48-inch main, rehabilitation of the existing trunk main system, erection of a 2-m.g. elevated tank, construction of a 5-m.g. steel reservoir and repumping station, and improvements at the raw water and filtered water pumping stations.

It was decided to carry out these two five-year programs simultaneously, financed on a pay-as-you-go basis through reserve certificates.

Priority Basis of Construction

It was evident that to complete the improvements to the distribution system within five years, construction would have to be carried on simultaneously in three sections of the annexed areas. Studies were made and

ATLANTA WATER WORKS
DEPARTMENT OF CONSTRUCTION AND DISTRIBUTION
PLAN OF IMPROVEMENT
SECTION B
PROGRAM OF CONSTRUCTION -- WATER MAINS

Number	Location	2"	6"	8"	12"	Days Required	Houses W	Houses UW	Maximum Distance From Hyd.	Est. Fire Flow	No. Pet'n	Remarks
B-6.10.19-13	Hollywood Rd., NW Mildred Pl.-St. Paul Ave.			3600		12		39	1300-400	0-700		New Water Service and eliminating dead end of 3.2 miles of water main.
B-6.10.19-14	St. Paul Ave., NW Hollywood Rd. - West to connect			700		2	16		500-250			
B-5.3.4-15	DeFoor Ferry Rd., NW Harper Rd.-Bohler Rd.				4500	15		57	2500-400	0-1300		New Water Service and Trunk Main.
B-6.1.3-16	Montissa St., NW Claremont St.-DeFoor Ferry Rd.		600			2		6	600-300			New Water Service.
B-6.82.6-17	Cambria Ave., NW Woodland Hills Ave. - D.E. North		600			3		5	800-400	0-1300		New Water Service.
B-1.17.14-18	Gary Rd., NW Bankhead Hwy. - Baker Ter.			2100		7		21	1050-400	700-1500		Additional Supply For 2.0 miles of unsupported 6-in. main in Bankhead Hwy.
B-6.6.21-19	N. Hightower Rd., NW Bankhead Hwy. - St. James Ave.			3900		13		40	2000-400	300-1700		New Water Service and reinforcing Carey Park area.
B-4.30.22-20	Spink St., N.W. Bolton Rd.-Bernard Rd.		2300			8	11	22	2000-400	0-400		New Water Service and fire Protection.
B-6.38.23-21	Bernard Rd., N.W. Spink St. - D.E. East		1300			4		11	1900-400	0-400		New Water Service.

Fig. 2—TYPICAL street from the construction program.

programs of construction, with mains listed in priority, were drafted for each section. The mains were given priority on the following basis:

1. The benefit the main would give to the general area.
2. How much it would improve domestic service.
3. How much it would increase the amount of water available for fire protection.
4. How many people it would provide with water service.

Programs of construction were planned for the new mains to be laid in 1952; and each year new programs of construction have been engineered and planned for the following year. Each main was laid with a definite purpose in view and selected according to the priority criterion. In cases where a main was to provide new water service, the streets nearest the former city limits were given preference.

The priority criterion was strictly adhered to and when inquiries were received on, "When are you going to lay a water main in our street," the potential customer was told the quarter and year in which he could expect water service.

In a project of this magnitude, planning had to be done well in advance in order to purchase the necessary pipe and accessories, and to set up a schedule for delivery so material would arrive as needed to insure continuous operation of the project.

Hydraulic field checks have been made frequently to determine if the new mains being laid, as planned in the program of construction, are of maximum benefit to the system.

A typical sheet taken from the program of construction is shown as Fig. 2.

Temporary Improvements

The fire flow tests indicated that in nearly all sections of the annexed areas the amount of water available for fire fighting purposes was very inadequate. From past experience and the hydraulic studies, it was evident that emergency measures had to be taken to improve domestic service in some of the areas. The hydraulic studies indicated that water was available in some areas and that the water could be forced by booster pumping from these points to the low-pressure areas.

Three temporary booster stations were designed and placed in operation in 1952. These temporary pumps were placed on automatic control. The pumps were set to start when the pressure dropped to a predetermined point. Pumping was around a check valve to raise the hydraulic gradient in the low-pressure areas. When the load dropped off, these booster pumps would shut off as the pressure on the suction side again rose to a predetermined level.

These booster stations worked very satisfactorily as an emergency measure until sub-feeder mains and trunk mains could be laid to reinforce the areas. Two of the booster stations have been taken out of service and the third is still in operation. This station will be eliminated as soon as it is practical to lay additional trunk mains into the area.

Specifications and Contract

To do this work under force account would have required considerable expansion of the Department of Water Works personnel. Therefore, it was decided that it would be better to do this work under contract. Specifications were developed and each year a contract has been let "to furnish all equipment and personnel and perform all labor necessary to install cast-iron water mains of various diameters and in various streets within the City of Atlanta." The Atlanta Water Works furnished all materials.

The streets in which the mains were to be laid were not specified in the contract. The contractors bid on a total footage of pipe to be laid with the amounts of various size pipe being specified. All bids were on an item basis. Item 1 was for laying pipe on a linear foot basis. Item 2 was for installing fire hydrants. Item 3 was for installing gate valves and Item 4 was for installing fittings. In each case bids were taken for each size and for both mechanical and lead joint. Items 5 through 9 covered the removing of rock and pavement, and the replacing of various types of pavement.

To determine the low bidder an evaluation sheet was included. This evaluation sheet was based on the total footage and accessories for each size of pipe.

The contractor was required to provide personnel and equipment to work in three different sections of the city simultaneously and to complete installation of the water main at a minimum rate of 400 linear feet per day, or 2,000 linear feet per week in each of the sections.

Each street was given a separate contract number. When the contractor completed the main in the individual street and the main was placed in service, he was immediately paid for work performed on that street. Thus, the contractor did not have to tie up his money for a long period of time. This saving to the contractor was reflected in the bid prices.

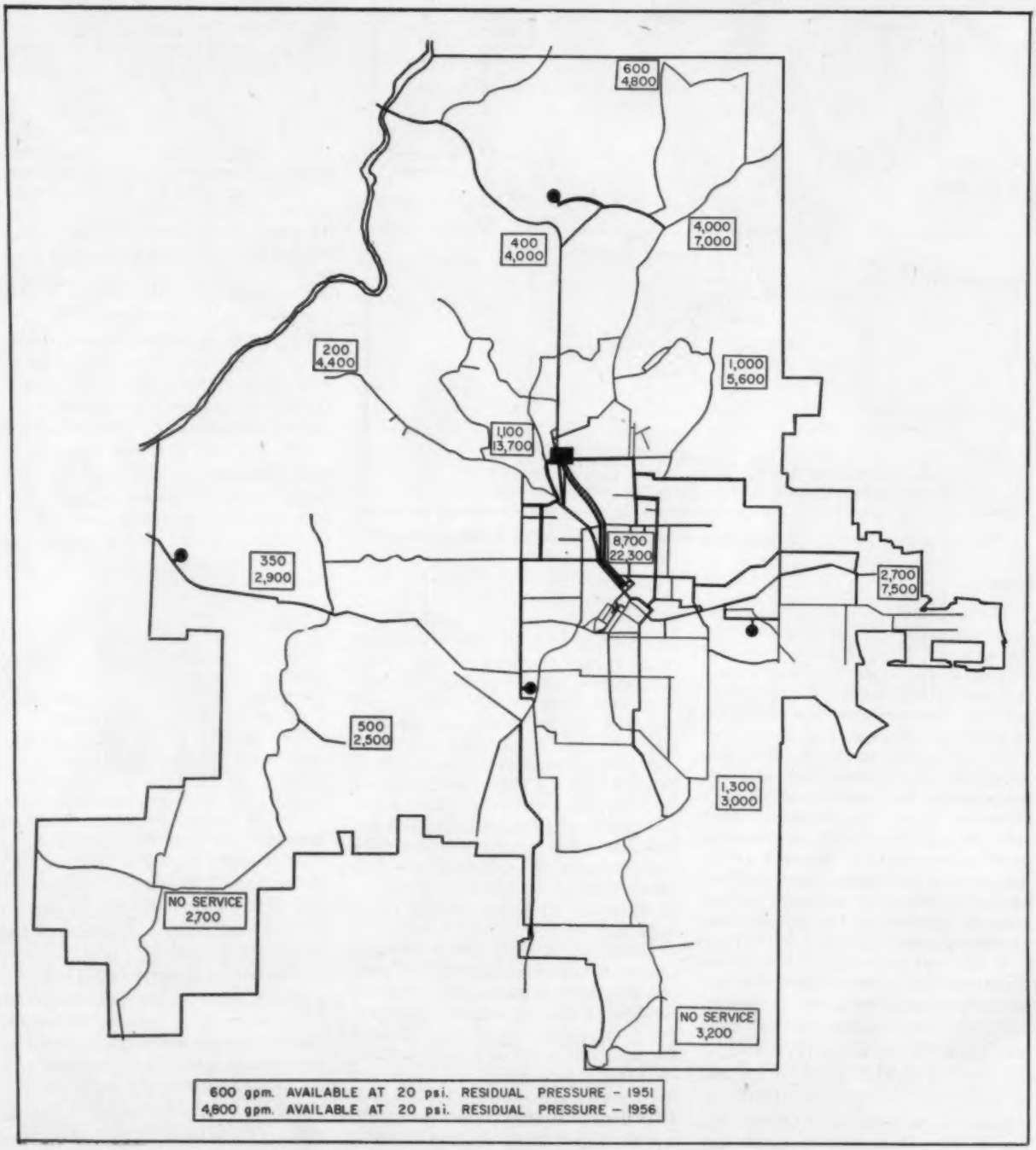


Fig. 3—FIRE PROTECTION improvements effected by changes in trunk main system.

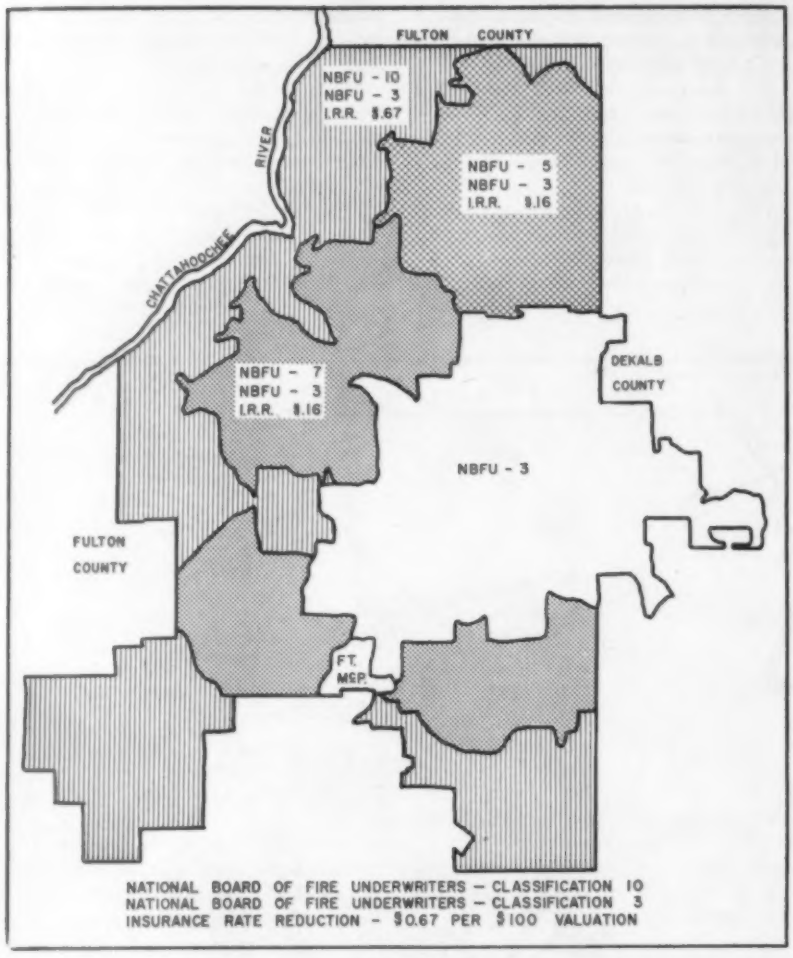


Fig. 4—REDUCTION in fire insurance rates due to improved water system.

Summary

The solution to the problems of supplying adequate water service to the annexed areas in most cases involved strengthening the distribution and trunk main systems from the former city limits toward the periphery of the annexed areas. The object was to provide water service to all people as rapidly as possible. The distribution system has been systematically developed to provide adequate water service and sub-feeder mains were used to strengthen general areas. Large trunk mains have been installed only where the need was acute to provide for expanding the system into unwatered areas.

It also was necessary to strengthen the trunk main system within the former city limits in order to supply water to these annexed areas. This was done by hydraulically cleaning the existing unlined trunk mains and in some cases permanently restoring their carrying capacity by cement lining. A 48-inch trunk main was laid from the main pumping station, approximately two miles into the system, to provide additional outlet from the Hemphill pumping station. Two 2-m.g. elevated tanks have been erected to reduce the load on the trunk main system during periods of maximum consumption.

During the last five years approximately 410 miles of main have been laid in the Atlanta distribution system. Of this, an estimated 260 miles have been laid under the Plan of Improvement in annexed areas and another 100 miles have been laid in these areas by developers of new sub-divisions. Within the old city limits approximately 50 miles of main have been laid.

These mains have provided water service to approximately 14,000 people who were without city water at the time of annexation, and have provided for expansion of the system in the annexed areas to supply another 44,000 who have built there in the last five years; also for an additional 10,000 new residents who have built within the former city limits. The program has provided satisfactory domestic service and water for fire protection to all of the 162,000 people who live in the newly annexed areas, and greatly improved service to 343,000 persons living within the former city limits.

These statistics are also interesting when reduced to an hourly basis. For example, during the last five years for each hour during the working day: 200 feet of pipe have been added to the Atlanta Water Works system; two new services have been installed; a supply has been provided for 6.2 new people who have moved here, and the water required to supply the City of Atlanta theoretically increases at the rate of 750 gallons each working hour of the working day.

The mains that have been installed during the Plan of Improvement program have substantially improved pressure conditions and the amount of water available for fire protection is now adequate in all sections within the new city limits. The very substantial increase in the amount of water available for fire protection, which has resulted in large reduction in fire insurance rates throughout the annexed areas, is shown by comparing results of fire flow tests made in 1951 with those made during 1956. These results for various representative locations throughout the city are shown graphically in Fig. 3. On the map at each location are two numbers; the upper being the amount of water (in gallons per minute) that was available in 1951 and the lower being the amount currently available for fire protection purposes.

Benefits

In the ultimate, the only measure of value that can be applied to any improvement is the benefit or saving it brings to the citizen taxpayer.

The benefits derived through this engineered program of expansion are that (a) at the present time all citizens within the city boundaries have an ample supply of water for both domestic use and for protection of their property in case of fire, and (b) the program has been so engineered that future expansion can be carried out without duplicating many of the existing facilities.

The saving in actual dollars to the annexed citizens has been two-fold. First, as a result of being within the city limits their water bill has been reduced by one-half, as all people who are furnished water outside the city limits are charged a double minimum rate. The second saving in actual dollars is due to the substantially re-

duced fire insurance rates that are now in force throughout the areas that were annexed. Fig. 4 shows the National Board of Fire Underwriter's insurance classifications by areas before annexation and at the present time, after improvements; also the reduction in insurance premiums as a result of the classification being changed to Class 3. The reductions shown are for a brick veneered dwelling, which is the predominate type of home construction in Atlanta. The saving in insurance premiums on commercial and industrial buildings was considerably more than on dwellings.

It is impossible to determine exactly the amount of money that is being saved each year on insurance premiums as a result of these rate reductions in the annexed areas; however, the best conservative estimate is that the saving is over $1,000,000 per year for the citizen taxpayers.

During the last five years the Atlanta Water Works has spent approximately $1,000,000 per year to improve the water service, which is the principle reason for the insurance rate reduction. The improvements are complete and the expenditure will stop, but the citizen taxpayers in the annexed areas will receive a saving from now on of more than $1,000,000 per year on their insurance premiums. This saving alone, which is a result of improved water service, has made annexation a good investment for them.

Acknowledgments

The author wishes to express grateful appreciation to W. D. Hudson, assistant Chief Engineer of The Pitometer Associates, who has been design and resident engineer on all this development project. Also to the following personnel of the Atlanta Water Works: Roy Ruggles, Chief Engineer of Construction; C. W. Cline, Assistant Chief Engineer of Construction; C. N. Davis, Superintendent of Maintenance and Distribution; J. Howard Bullard, Assistant Superintendent of Maintenance and Distribution; and all the others who have given tirelessly of time and effort to insure the success of this program. Also to the National Board of Fire Underwriters and the Southeastern Board of Fire Underwriters for their cooperation and council.

The author also wishes to express appreciation for the interest manifested in this important program by Mayor William B. Hartsfield of Atlanta; Alderman James E. Jackson, Chairman of the Water Committee; and the Board of Alderman of the City of Atlanta.

Ben Gotaas Moves To Northwestern Univ. As Dean of Engineering

Beginning with the second semester of the school year, Northwestern Technological Institute of Northwestern University will have a new Dean. He is Harold B. (Ben) Gotaas, who for the past ten years has been Professor of Sanitary Engineering at the University of California.

Inasmuch as Prof. Gotaas has long been identified with research at the University of California, he will strengthen the research facilities and activities at Northwestern. Until such time as present research projects which he had under his direction at California are completed, he will continue to participate in their direction.

Having spent most of his professional career in the field of sanitary engineering, Dean Gotaas may also be expected to expand the civil engineering field including water supply, sewage and waste disposal and air pollution. He also spoke of adding a department on area planning to round out the University's approach to the general problem of public works.

Dean Gotaas' professional career encompases teaching at three Universities, and service with the Army during World War II. A graduate of South Dakota he holds a Masters degree in Structural Engineering from Iowa State Univ., a Masters degree and an ScD. in Sanitary Engineering from Harvard. His first professional assignment was at South Dakota University before he went to Harvard for graduate study; his second teaching assignment was at the University of North Carolina where he became Professor of Sanitary Engineering.

In 1942, Dean Gotaas entered the Army and was assigned as Chief Engineer of the Institute of Inter-American Affairs at Washington, D. C. He later became Director of the Health and Sanitary Engineering Division and in 1945 was named President of the Institute. Following the war he became Professor of Sanitary Engineering at the University of California in Berkeley. For five years he served as chairman of the Dept. of Civil Engineering and he was also Director of the Univ. of Calif. Sanitary Engineering Laboratory.

Still a Miracle to Most

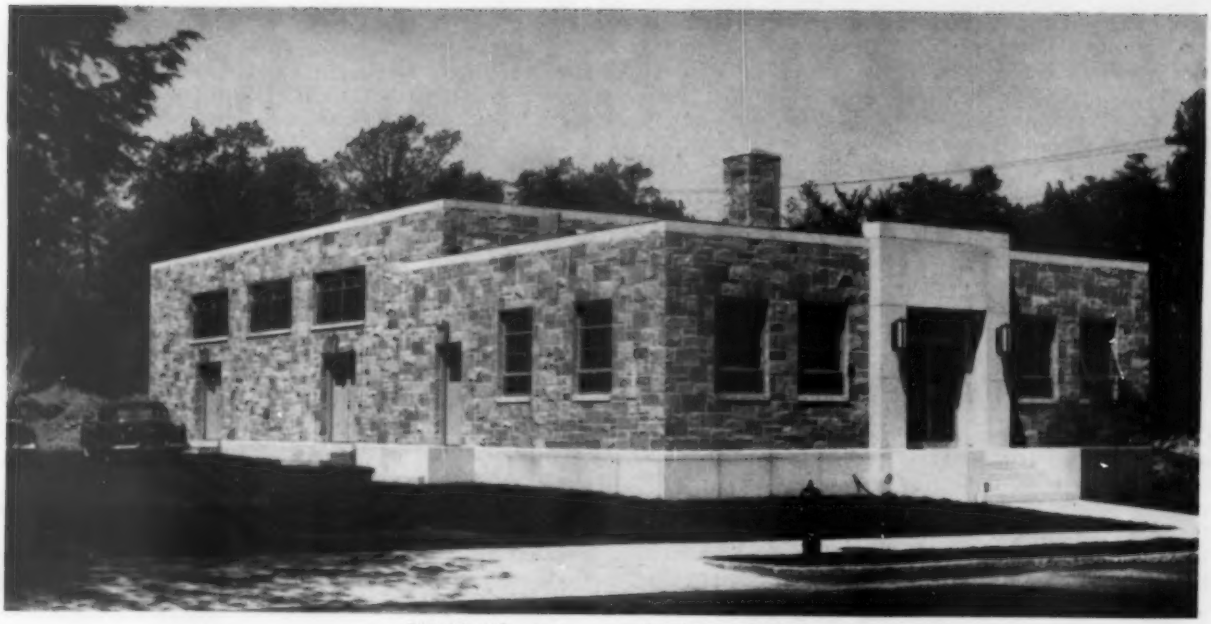
Even with all of our scientific prowess and scientific understanding, this World of ours is still a Miracle to most of us—to those of us who believe that it takes more than science to explain it.

Prof. Gifft of Cornell Died Suddenly

Prof. H. M. Gifft, Prof. of Civil Engineering and Dean-elect of the University Faculty of Cornell University died unexpectedly at his home last December 20. He had been Head of the Sanitary Engineering Department in the School of Civil Engineering for the past ten years. His appointment as Dean of Faculty had just been confirmed by the Board of Trustees two days before his untimely death.

Prof. Gifft was a graduate of Iowa State College in 1932. He received his graduate and professional degrees and was appointed to the Faculty of Cornell University. In 1946 he became head of the Sanitary Engineering Department.

Prof. Gifft was well known throughout the profession as a teacher, consultant and author. A number of his articles have appeared in *Water & Sewage Works*. He was a member of the consulting firm of Bogema, Gifft and Jenkins in Ithaca and among his consulting assignments were several summers spent in the Panama Canal Zone.



PUMPING station - - Brookline, Mass.

Operation and Maintenance of Water Distribution Systems*

by WALLACE T. MILLER

Mr. Miller is Research Engineer of the Cast Iron Pipe Research Association in Chicago and a former water works superintendent. In this article, he presents a summary of modern tested practices.

THE GENERAL SCOPE of the term water distribution system is very broad and would normally include distribution mains, valves, hydrants, service connections, meters, booster pumping stations, storage facilities, maintenance shops, etc. This article will cover the major items under this classification and particularly in respect to the more important considerations rather than a complete coverage.

MAINS

The specific locations of water mains are worthy of consideration in the early stages of planning. Many communities originally attempted to install water mains as near to the center of a street as possible, particularly in municipally owned utilities, and this no doubt developed from the thought of equalizing the cost of installing water service connections to property owners on each side of the street. As a result of a great preponderance of paved streets, it is very apparent that an effort should be made to keep water mains outside the limits of paved areas wherever possible. This general rule applies whether streets are already paved or are located within new subdivisions where paving will eventually be installed. The cost of removing and replacing of pavement can be a very considerable part of water main installation or maintenance cost and should be avoided wherever possible.

Selecting the Location, Size, and Joints

The selected location for the water main should prevent close proximity to any existing or proposed sanitary sewer or storm sewer. Many State Health Departments desire at least 10 ft horizontal spacing. Wherever it is deemed necessary to install water mains in the same trench with a sewer main, the water pipe should be laid on an undisturbed earth shelf on one side of the sewer trench and at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer main.

In many cases, it can be determined that a two-main system can be installed on a street already paved at a cost which is no greater than the installation of a single main within the limits of the paving. In this case, a main would be located on each side of the existing street, one being sufficiently large to provide adequate flow

* An article based on illustrated talks on the subject given at water works short schools in South Dakota, North Carolina and Wisconsin.

for fire protection and other large flow requirements. The other, furnishing domestic service only, would be a main no smaller than 2-in. in diameter and connecting to larger size mains at each end of the block. The avoidance of pavement cutting and other work within paved areas, except at street intersections, will frequently provide sufficient funds to cover the cost of the second small main. Future maintenance costs may be considerably reduced. (See Fig. 1)

The matter of adequate sizing of mains is of prime importance prior to original installation and due consideration of future needs will avoid many maintenance problems at a later time. A minimum size of 6 inch diameter should be provided for any mains serving fire hydrants; long lines of this size, however, are likely to provide inadequate service. Any mains less than 6 inch diameter should be considered water service lines. Sizing of mains is a matter which is worthy of an extensive engineering study by a qualified engineering staff and should not be approached on a casual basis.

Selection of the type of joint most suitable and desirable for particular installation should also receive due consideration. Not many years ago most cast iron installations involved bell and spigot joints utilizing lead, sulphur compound or neat cement for joint materials.

For some years, the use of mechanical joint pipe has been gaining in popularity and now represents the joint which is most frequently used on new construction. This joint is very simple to install, has definite advantages over the bell and spigot joint and usually represents no increased cost. The mechanical joint is bottle tight, provides greater flexibility, reduces labor costs, eliminates separate jointing materials and can be readily assembled in a wet trench.

The most recent development in cast iron pipe is the Roll-on joint involving a compressed rubber gasket in a bell and spigot type of joint and in general this is the joint with the lowest cost installed. Flange joints are generally used for pumping station piping and other above ground installations. A ball and socket joint, usually called a submarine joint, is most appropriate for crossing rivers or other bodies of water.

Leak Repair

One of the most important maintenance operations in connection with water distribution systems involves repair of leaks. A very large percentage of leak repair work in the distribution systems, probably at least 90 per cent in most systems, is represented in service connection leaks. Most of the older service connections used lead, wrought iron or galvanized iron pipe and these are more susceptible to failure than most other parts of the system.

It is generally conceded that the replacement of an old service connection in its entirety through use of copper tubing or other satisfactory material, is much more economical than repairing an old service connection of unsatisfactory material. Where it is deemed advisable to repair an old service connection, several types of mechanical couplings are available for convenient repair.

Most leaks which do occur on mains are joint leaks. If sulphur compound has been used, the joint material may be cut out or burned out and the joint repoured. Lead joints can be recalked or clamps may be installed to provide a more permanent repair. It is somewhat common practice, where bell and spigot joints are used, to install joint clamps during the original installation on mains which may be located under railroads, superhighways or other vulnerable spots.

For the relatively small number of breaks which occur in water distribution system mains, a great variety of mechanical clamps or sleeves are available for permanent repair. Prior to World War II it was difficult to get water works operators to think in terms of mechanical clamps as being anything other than a temporary repair and it was not uncommon for them to be used on a temporary basis for a quick repair and later removed. Operators have now been convinced that a mechanical repair clamp is a completely permanent repair item and mechanical fittings and pipe are common on new installations.

Mobile Radio for Leak Repair Operations

One of the most important tools in the repair of leakage on water distribution systems is to provide rapid and complete communications. All large water utilities, and many small utilities, have already provided communications through short wave radios or mobile telephone service. Invariably it is found that this type of service will pay for itself within a very short period of time through reduction of labor costs during periods of emergency. It also provides a considerable reduction in the time of disruption of service, which considerably improves public relations.

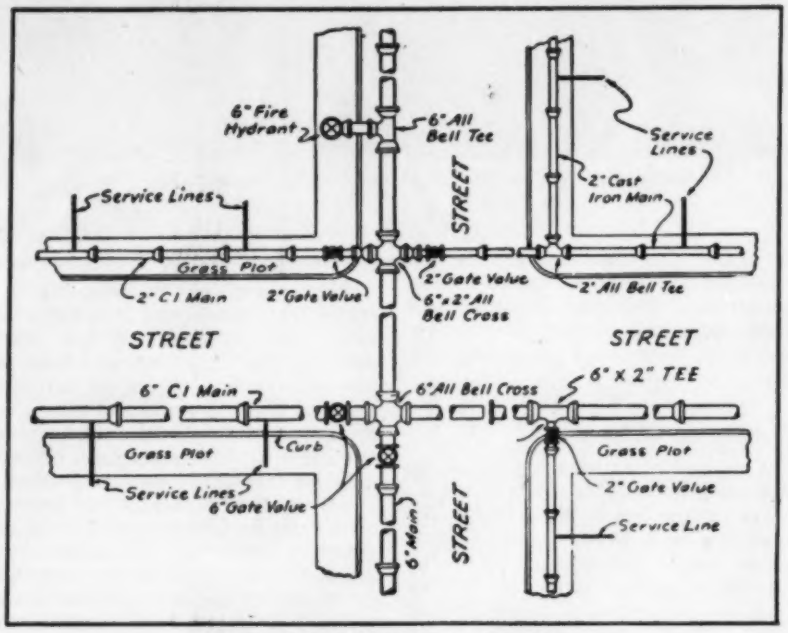


Fig. 1—DIAGRAM of two-main system

Main Flushing

One of the frequent sources of difficulty in many distribution systems is the existence of red water and the need for flushing at least a portion of the distribution system. Many systems find it desirable to provide at least a routine seasonal flushing. A complete flushing of an entire system should always provide for reversing the normal direction of flow and an increase in velocity which can usually be accomplished through closing certain valves on the system. Treatment

INSTALLING mains—42-in. roll-on-joint C.I. Pipe—Chicago, Ill.
Placing offset in 8-in. main

of water can be very effective in avoiding the creation of red water problems and cement lining of cast iron mains will prevent the development of red water in a piping system.

Disinfecting Mains

One item of extreme importance in operating procedures which is not always undertaken is the need for disinfecting new mains before placing these mains in service. Chlorine should be applied at the rate of not less than 50 ppm and should have at least a 24-hr contact period.

Holding of such a main out of service after complete flushing, until bacteriological analysis can be completed, is often inconvenient but should always be provided. Invariably, there seems to be some customer waiting immediate service and frequently this time element is shortened in order to convenience the customer.

It is not desirable that the time element be shortened, the bacteriological analysis should be undertaken and state health department regulations should be literally followed in each state. The AWWA has published a standard procedure for disinfection of water mains and this is available in reprint form.

Occasionally it is desirable to use chlorine in relatively concentrated dosage to eliminate the formation of slime growths in mains. This procedure can be very effective and usually requires a high velocity flushing following the disinfection.

Maintaining Capacity

The maintaining of adequate capacity may develop as a problem in many water systems and this situation has been extremely prevalent in too many systems during the past few years of heavy demand and extensive droughts. Many articles have been published on the procedures necessary for completely analyzing distribution system capacities. A project of this nature invariably requires engineering talent for a complete hydraulic survey and it is not desirable to delay such needs until inadequate service is experienced. An effort should be made to anticipate increased demands on the system and to provide reinforcements in time to meet such needs.

Non-revenue Water losses

Of great importance in the operation of any water distribution system is the need to minimize losses through unaccounted-for or non-revenue water. Probably the best safeguard which can be undertaken to provide a high percentage of accounted-for water could generally be referred to as development of a good maintenance program. Water produced can become non-revenue water through inaccuracy of meter registration, leakage in the system, stolen water and from other causes.

Frequently this unaccounted-for water is extensive enough to warrant expending money for professional leak surveys which would cover all phases of the system. In the absence of undertaking a professional survey of this nature, simple leak surveys may be undertaken by any water department regardless of size. For example, there is a case on record of a municipal water district of some 500 customers where only one gallon of water was recorded on customer meters for each four gallons of water purchased through the master meter. This is an absurd as well as expensive situation and the exertion of nothing more than simple effort would result in saving a very large part of the unaccounted-for water.

More than 20 years ago the writer became associated with a municipal water utility which produced one million gallons per day and accounted for only 67 per cent of the water produced. Over a four year period a simple leak survey was diligently undertaken with the result that production of water remained at one million gallons per day, during a period of modest growth, and 87 per cent of all water produced was recorded on customer meters.

The procedure followed to increase accounted-for water by 20 per cent was very simple. An extensive meter maintenance program was undertaken. Repaired meters were required to meet a rigid test. Many very old meters were replaced with new meters.

A simple leak survey was undertaken which involved listening for leaks on every customers service, at the meter location and at the curb shut off. Listening devices were also used on every hydrant and every valve in the entire distribution system. During the course of the survey every curb shut off was operated and those failing to operate were promptly repaired or replaced. The entire increase in accounted-for water was the result of repairing leaks located in the distribution system and obtaining accurate registration of meters.

Safety

In conducting operation and maintenance work as well as in new construction, definite effort should be made to prosecute the work under the best standards of safety practices which are known. This is a responsibility of the manager of any water utility and a safety program should be in existence in every utility regardless of size. The AWWA has recently published a manual on safety practices related to the water works industry.

VALVES

One of our first concerns in respect to valves in a water distribution system relates to the location and extent of valve installations.

WATER MAIN withstood ravages of 1955 flood and continued in service at Winston, Conn.

Number of Valves

The ideal installation might provide for four valves to be located at every water main intersection and, if blocks are unusually long, it may be desirable to install intermediate valves within a particular block. Most new main installations involve undeveloped areas or areas in the process of development as residential areas. Too frequently we think of present day need for valves and have a tendency to install an absolute minimum number. The same areas, when completely built-up, naturally present a greater need for valves and this should be borne in mind at the time of original installation. It would be difficult to find a water distribution system where a surplus of valves had been installed.

Industrial Connections

Where industrial plants or other large and important customers are connected with a distribution system, it is good practice to encourage the customer to provide two connections to the main and to locate a valve between the two points of connection. In this way, it is possible to continue service to the customer regardless of the need to shut down a main in the particular block in which service is provided.

Loss of water service to an industry can result in a complete shut down of the plant and the loss of thousands of hours of labor. Even though such a shut down may occur very infrequently, the avoidance of complete loss of water service to industrial users is well worthy of consideration.

Valve Operation

We hear a great deal as to the frequency of operation of valves. It is, of course, to be desired that each valve in the system be operated at least once a year but few small systems undertake a program of maintenance which will provide this. Some consideration should be given to the operation of valves, particularly important valves in the system.

Operators should be well trained to provide a reasonable time for closing and a definite avoidance of closing a valve too quickly. The number of turns required for complete opening and closing of every valve in the system should be known at the time of operation. Motorized valve operating equipment is becoming more common and represents an indispensable item of equipment in many departments. By-passes on large valves serve a very important function in connection with valve operation.

Packing Glands

Probably the greatest source of annoyance in connection with valve maintenance arises from difficulty with packing glands. Unless valves are located within valve chambers it is not convenient to tighten packing gland bolts or to replace faulty packing. Some assistance has been provided through equipment which permits some lubrication of the packing through the valve box. Valve chambers are desirable on large major valves where such are located within the area of rigid pavement.

Standardization of Valves

The matter of standardization of valves must be considered in any system in respect to the needs of that particular system. The same factors applied to valves will probably apply to meters, hydrants, and other items of material and equipment in any system. In ordering new parts for very old valves, it has been found desirable to purchase a complete set of internal replacement parts rather than procuring an individual item such as a stem, disc, etc. Use of a complete internal valve assembly will accomplish the most effective repair and will avoid difficulties which might be experienced in combining old and new operating parts.

A water works system should involve either right hand valves entirely or left hand valves entirely, but practically every system has a few valves which operate in what represents a reverse direction for that particular system. When that condition does exist, precautions should be taken to avoid assuming that the valve operates in the conventional direction. This may be accomplished in several ways. There are some systems where red paint is applied to the underside of the valve box cover to designate a particular valve as being unconventional in direction of operation. In other systems a similar precaution

TIEING-IN 16-in. cement lined C.I. feeder main with 131 year old 10-in. pipe—Philadelphia, Pa.

is undertaken through placing a piece of 2 x 4-in. timber in the valve box and the necessary removal of this calls attention to the reverse direction for operating that particular valve.

Valve Boxes and Records

Valve boxes should be maintained to provide accessibility to the operating nut at all times, even though this sometimes involves a considerable expense. A valve in the system is of no value whatsoever if it is not accessible for operation. Plugged valve boxes may frequently be cleared by flushing out with high pressure water through a small nozzle or by a blast of air from a compressor. In recent years we have experienced the repaving of many concrete highways through the application of about 2½-in. of blacktop on top of the old paving. This represents a problem in the adjustment of valve boxes, but a small unit is available for placing in the top of an existing valve box to adjust to the height of the new pavement.

Valve record cards are probably the most important item of records relating to the distribution system. There are many ways of providing reference measurements to determine location of valves and a standard system should be adopted in each department. Records of this nature should always be developed from the point of view of convenient field use and not on the basis of an office record which is not immediately available in the field.

HYDRANTS

Location

The matter of spacing of hydrants is important in a system and there is a wide variation in the spacing used. In residential areas it is desirable that hydrants be no farther apart than 600 ft. In any case, every building should be within 500 ft. of a hydrant. Business and industrial areas require closer hydrant spacing. Wherever possible, it is most desirable to locate hydrants at or near intersections so that they may conveniently serve along blocks in each direction.

If hydrants are placed between corners, an effort should be made to locate the hydrant opposite property boundary lines. They must be protected from damage by vehicles. Most customers object to having a hydrant located in front of their property and it has been found desirable to stake the location in advance, with a stake clearly marked "hydrant", so that any difficulty with customers can be worked out prior to placing the hydrant. Be sure to avoid future driveway locations. A standardization of threads must be established and steamer connections should be provided.

Valves should always be located on branch connections to hydrants and location on the branch near the point of connection to the main is more desirable than any other location.

Inspection

Hydrants should be inspected periodically to insure proper operation, adequate drainage and to provide necessary lubrication. Use of hydrants by persons other than department employees should be avoided due to possible damage through misuse, quick closing, etc. Where hydrants are used for sewer flushing, an auxiliary valve should be placed on the outlet and this valve operated rather than the hydrant valve, during the progress of such work. It has often been found practicable and desirable to furnish services of a department employee to operate hydrants rather than to permit operation by others.

Painting

Painting of hydrants should be standardized in any department and should be applied frequently enough to maintain a completely satisfactory and attractive appearance. In most water systems, hydrants are the only part of the system which are in evidence to the public and a neat appearance will provide public admiration. Many departments have eliminated chain connections to outlet caps and when these caps are made wrench tight, little disturbance or loss of caps may be expected.

It is generally desirable to indicate the flow capacity of a particular hydrant through marking in some manner. Flow tests should be undertaken to determine flow capacities and hydrants marked accordingly. Some departments prefer to indicate the size of the street main and mark this information on the hydrant rather than indicating the capacity. Any information which can be provided will be of use to the fire department and help to establish good relations.

Wherever hydrants may be taken out of service for a temporary period, or have not yet been provided with service during the construction period, a burlap bag should be placed over the hydrant or the hydrant marked in some way to indicate it is out of service. Hydrants should not be used for water required in private construction projects.

Hydrant record cards should be provided and all maintenance work undertaken on each particular hydrant should be noted on a continuing record. It has often been found desirable to have maps placed in fire houses to provide information on location of hydrants for assistance to fire department personnel.

SERVICES

Small service connections are generally made through installation of a fitting referred to as a corporation stop but it is difficult to establish the manner in which this name came into common usage. It is noted that plumbers in many areas of the country refer to water main piping as "corporation" pipe. Before the time when large private corporations were established, municipal governments were known as "the corporation". People who worked for the state, city, town or village on highway or other type of outside work, were generally referred to as "working for the corporation". The writer feels that this is the manner in which the designation of corporation stop came into common usage.

Sizing the Service

Determination of proper size of service connections for any particular customer should be given consideration at the time of application. There are definite disadvantages to installation of a service connection which is too large or too small for the particular type of service. The size of the service generally determines the size of the meter to be installed and a meter larger than required is likely to result in under registration on small flows.

In most areas it is common practice to install meters one size smaller than the size of the service connection. A service connection which is too small for the service desired will, of course, result in complaints of inadequate service. Some departments, as long as 20 years ago, were installing a minimum size service connection ot 1-in. copper in order to provide completely adequate service many years later.

Selection of material should be given adequate consideration. Copper tubing is by far the most popular material for small service installations. In most cases, the corporation stop is inserted at an angle of 45° above horizontal with sufficient piping material available to provide for some movement of the service connection piping without creating a strain at the point of connection.

When the corporation stop is not conveniently available for shutting off to undertake repairs, excellent results may be obtained through use of dry ice for freezing. It is often found desirable to replace old service connections rather than to accomplish a repair, once a failure has occurred.

Curb shut offs should be maintained in proper operating conditions at all times and this will require periodic inspection and operation. Lids for curb boxes have a tendency to become damaged but repair lids are readily available and easy to install. A plugged curb box may frequently be cleared through use of blowing out with high pressure air or washing out with a jet stream.

Cost of Installation

In the majority of municipal operations, the cost of installation of a service connection is generally paid for by the customer and in some cases the department requires maintenance of the entire service connection at the expense of the customer. It is felt desirable that all work performance in maintenance of service connections, between the main and the curb shut off, be undertaken by department forces, even though the cost of such maintenance may be charged to the customer.

Care should be exercised to install service connections at sufficient depth to prevent freezing. The thawing of frozen services is not particularly difficult but has considerable nuisance value, develops poor public relations and requires a continuous flow of water being maintained after thawing until all danger of freezing is over for the season.

There are a variety of opinions as to the advantages of installing service connections in advance of building needs and this has resulted from the extra expense required for installation after pavement has been completed. Pipe pushing and boring equipment has effectively reduced the amount of open trench installation. Too frequently service connections installed many years in advance of building needs have resulted in the stub service being at the wrong location or of inadequate size. The particular factors related to each individual community would be of great importance in establishing a policy. The two main systems eliminate the need for such considerations.

As is true of all other distribution system appurtenances, service record cards are of great importance. They should effectively designate the particular location of the point of tap and curb shut off and should provide a convenient method of satisfactory measurement to locate the curb box rapidly. The record should also include installation details and any maintenance work performed on the service connection.

METERS

Nothing is of more importance to good revenue production than an adequate meter maintenance program. All small meters should be brought into the shop, cleaned, repaired, tested and properly adjusted on a periodic schedule. Large meters require similar work in the field. The frequency of inspection and maintenance varies on small meters from five to ten year periods but should logically be based on the volume of water passing through the meter rather than time.

Many large utilities remove residential meters upon registration of one hundred thousand cubic feet. Average sized families would be expected to use this amount in approximately ten years. Privately owned utilities are generally regulated through state utility commissions and definite schedules for meter maintenance are established.

Meters should be located in such a manner as to provide convenient access for reading by meter readers. Any poor settings or locations should be corrected at the earliest opportunity.

MOBILE radio phone aids communications—Cape Cod, Mass

It is frequently found that municipal utilities require purchase of a meter by the customer even though control rests with the utility. Since the meter represents the cash register of the water utility, it is desirable that both ownership and control be vested in the water department. One of the great advantages is represented by the fact that ownership by the utility avoids the necessity of maintaining any particular meter at the same location at all times.

The meter maintenance shop should be adequately equipped to provide the complete requirements of testing and repairing. An excellent article on "Equipment and Layout of Meter Maintenance Shop" appeared in the June 1954 Journal of AWWA.

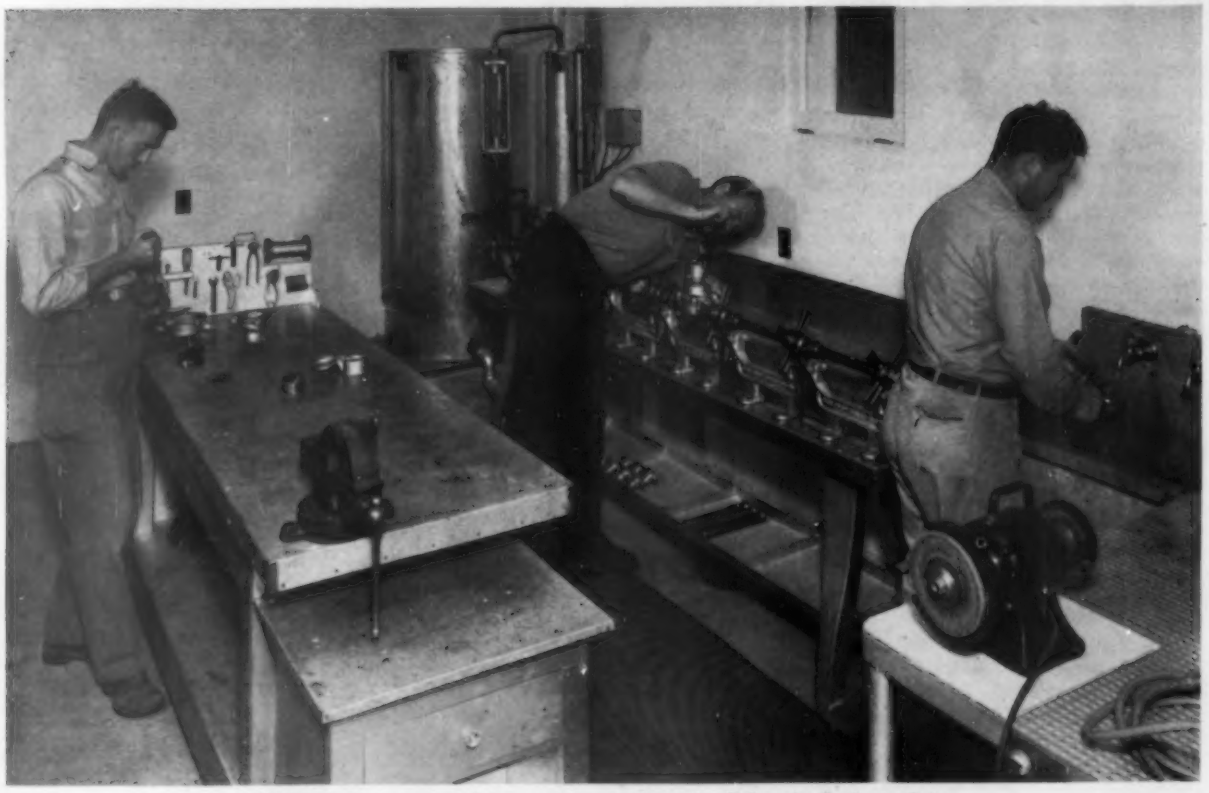
STORAGE

Whether storage of water in the system is maintained as ground storage in open reservoirs or as elevated storage in tanks and standpipes, it is important that good housekeeping be maintained to set a pattern for the community. These facilities are in the same classification as city buildings and all other public property and should always be outstanding in appearance. Invariably good housekeeping of this sort will also provide more effective use for longer life.

There is a wide variation of opinion in respect to use of supply or storage reservoir property for recreational purposes. It is necessary to guard against misuse and recreational use might better be avoided unless adequate policing can be provided, rather than to permit a nuisance and possible source of pollution to develop.

DEMANDS

During the past few years of frequent droughts in many areas of the



METER test shop containing modern equipment—Colorado Springs, Colo.

country, more than one thousand water systems throughout the U.S. have found it impossible to meet total demands on their systems at some time during the year. The developement of our high standard of living has resulted in continuing increased use of water by all consumers and the population of the country is growing by leaps and bounds.

Industrial demands have grown steadily and it is anticipated that they may more than double in the next 20 years. Air conditioning is developing a tremendous load on some water systems in commercial and industrial areas. Lawn sprinkling has frequently developed peak demands far in excess of adequate fire flow requirements in residential areas. Fire flow requirements were formerly used to determine peak capacity needs in many water systems but industrial and sprinkling loads may be expected to exceed these demands in many areas.

The operator of a water distribution system should be entirely familiar with what is taking place on the system during periods of peak use. Pressure tests under peak loads are of tremendous help in determining adequacy of service or need for reinforcement of any particular part of the system.

It is relatively simple to obtain hydrant pressures throughout the system during these periods. Pitot and fire flow tests must be undertaken periodically to develop information for necessary hydraulic study at frequent intervals. Major hydraulic grade study or similar investigation of conditions should be undertaken at regular intervals to provide long range planning on any system. A considerable amount of information may be obtained during the peak season by water department forces which will provide valuable information for both short range and long range planning.

CUSTOMER SERVICE

The legal obligations related to water service on the part of a utility are generally within the limits of public property. The exception might be the meter, which may be located in the customers premises. However, the utility may well consider a moral obligation to extend service, but not necessarily responsibility or repairs, to include matters related to the use of water within the premises. This philosophy of service is rather extensively performed in the electric, gas and other utility fields.

No matter how well a water distribution system may be operated or maintained, the existance of unsatisfactory conditions within the customers premises may result in unwarranted criticism of the utility.

One of the most extensive problems of customer service in a water utility is the handling of complaints. These represent a tremendous variety but in general most complaints, regardless of the foundation, occur at a time when the consumer has just received or is proceeding with payment of a bill. Complaints should not be treated lightly, since the average customer may have some reason for complaining only once in 10 years or more time and yet this will likely be his only contact with the department during that period of time.

In order to perform the function of the department and maintain good public relations, it is necessary that adequate service be rendered to the customer. Every complaint is worthy of complete investigation and when complete investigation is undertaken, there is invariably a reasonable answer as to the cause of the condition which resulted in the complaint.

Complaint Handling

The most frequent complaint from customers relates to what may be classified as an unusually large or at least an increased bill for water. In one particular municipal utility, an extreme effort was undertaken to definitely prove the reason for the increase in consumption which resulted

in the complaint. In practically every investigation, a satisfactory answer was determined and it was rare to find a case where this was not true.

The procedure which was used provided for sending an inspector to the property with complete information as to meter readings, dates and consumption recorded for several periods prior to the current period under investigation. An additional reading at the time of investigation, which probably involved a relatively short period following the previous reading, was first obtained and all usage was converted into average daily requirements for each period in gallons or cubic feet per day. These units can easily be extended for 90-day periods for convenient comparison when discussing quarterly consumption with the customer.

Actual tests were made to determine exact requirements for water in the operation of each water closet at the property. A record was made of any appliances requiring water. The number of persons served at the property was of great importance and was used in establishing per capita uses for comparison to average demands by other customers. Every complaint resulted in a complete letter report to the customer from the manager or a conference between the customer and manager to discuss all of the factors involved.

It was generally found that the majority of complaints relating to increased billing resulted from leakage within the customer's property. It was determined that alertness on the part of the meter readers could determine this prior to the actual billing time and generally resulted in more prompt repair of leaks. Meter readers were trained to make comparisons with consumption during previous periods at the time of meter reading. If increase consumption were noted, they immediately listened on the service at the meter to determine whether water was running continuously. Wherever possible, the matter was discussed to some extent with the customer at that time. If the matter was not resolved immediately, the meter slip was designated by code number as requiring additional investigation by an inspector. In this way the majority of increased bills was investigated and resolved from one to three weeks prior to the actual rendering of the bill.

A continuing program with conscientious effort can result in tremendous improvements in public relations as well as considerable savings through reducing wastage of water.

CAUSES of leaks. Assortment of service pipes—Glen Ellyn, Ill.

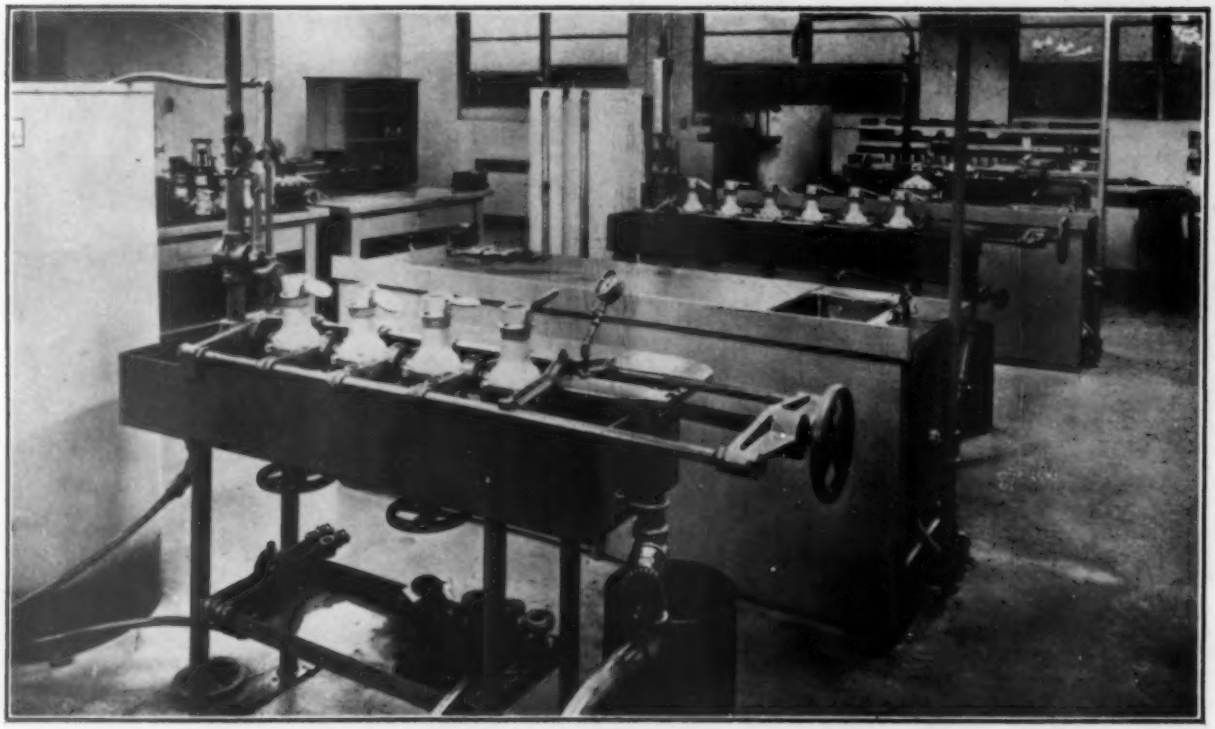
Meter Reading

Wherever access for meter readings cannot be obtained, it is generally desirable to leave a post card to provide for convenient reading by the customer. Where this has not been found satisfactory, arrange to leave some notification that an effort has been made to read the meter. Efforts of this nature are always a safeguard against complaints which may result at some future time since many customers became very irritated when their regular billing period has been skipped, or estimated bills are established.

Capable and alert meter readers can be a most valuable asset. Too often their work has been limited to nothing more than a simple recording of a meter reading. Most meter readers are capable of using good judgment and should be encouraged to observe and report changes in rate of consumption, as well as any unusual or undesirable conditions. Many such conditions occur frequently and may be conveniently reported by code number. Any follow-up required may be undertaken by other employees. In one department, the following code was attached to each meter readers book to permit ease in reporting that he was aware of specific factors at the time of reading, or conditions which required some further effort.

1. Meter not registering
2. Was a leak—has been repaired
3. Water closet leaking
4. Bad faucet leak
5. Meter coupling leaking
6. Meter stuffing box leaking
7. Meter registering slowly—indicating leak
8. Meter registering slowly—water cooled equipment
9. Consumption high—reading correct
10. Consumption low—reading correct
11. Meter not accessible
12. Premises vacant—left card
13. Quarantined
14. Glass broken
15. Register broken
16. Frozen
17. Meter set backwards
18. Hear water running—meter not registering
19. Meter seal broken
20. Meter working O. K.

When attempting to provide an efficient operation of a water distribution system, nothing pays greater dividends than the exertion of a sincere, conscientious effort and the application of good common sense on the part of the manager.



METER test benches in water department—Edmonton, Alberta

Why Water Meters are Advantageous*

Case histories show benefits of 100 per cent metering to water utilities

by H. G. GREER

Mr. Greer is a sales engineer with Neptune Meters, Limited in Toronto, Ontario, Canada.

In this article he cites examples to prove his thesis that water metering is good business.

WATER—one of the essentials of life—should be free to all. Yes, as free as when quietly resting in a lake, running in a river or babbling in a mountain brook. That it is free in either place will not be denied, yet when we come to utilize it for domestic purposes it will cost either money, time or labor and will have a fixed value per gallon.

Water cannot be obtained from any source without an investment that has a money value, be it either time or labor. If we go to the lake, river or brook, where it flows as free as the air we breathe, we cannot procure it and carry it home without labor, and we find it does cost something.

Under no circumstances can we obtain water without it having a fixed value represented by money, including the cost of pumping, filtration, addition of chemicals to make it fit for human consumption and the vast delivery system of water mains throughout the municipality to deliver it to each and every fixture in every home and every industry twenty-four hours a day. Standing by whenever it is needed, be it a glassful or thousands of gallons to put out a fire.

Metering is Equitable

Every good citizen will feel it a duty to pay his proportion of the cost for the convenience, the labor of taking care of the works, the chemicals to purify it and the interest on the money invested, etc. Theoretically, every consumer of water does assent to this, but practically he ignores it entirely. It is not infrequent for consumers to use many times the amount of water allotted to them, seeming to be utterly oblivious to the fact that they are doing a great moral wrong to their fellow citizens who are made to pay for their individual waste.

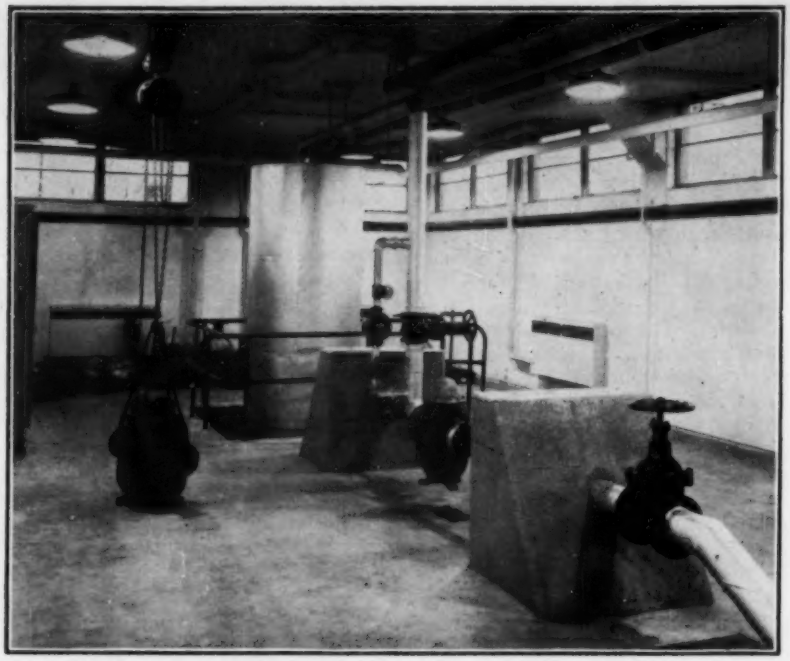
*A paper presented at the Western Ontario Water and Sewage Conference. Published here by permission.

Often there is extravagance in the use of water, and like every other extravagance it is difficult to reform. It is but right that the use, purification and distribution of water, with all its blessings, should be subjected to the ordinary principles of equity and economy. No person will be charged for more than he consumes, nor will any be allowed to use water at the expense of his neighbor. This is accomplished by the use of a water meter. The water meter makes possible the establishment of a water rate fairest to each consumer. The water meter is the yardstick of the municipality, which registers in gallons or cubic feet as the case may be, in the same way in which you would buy gasoline for your automobile or a pound of sugar at your grocer's. The municipality requires a certain amount of money to operate for a given period of time, which they must collect from each consumer to pay for water mains, filtration plants, pumping equipment, the salaries of the personnel of the water department, sewage disposal plants, etc., and power to pump each and every gallon consumed or wasted. The consumer pays exactly the amount used and no one is required to pay for the carelessness of others. The equity of this is universally recognized in the case of electricity and gas.

The installation of meters on all services has proven a successful means of checking waste. A leaky toilet or faucet is no longer allowed to go unattended. It is repaired at the first possible opportunity, as the consumer soon realizes that a leaky fixture will pass many gallons that directly affect his pocketbook. Lawn sprinklers and hoses are allowed to run only long enough to do the necessary job of supplying sufficient moisture to keep the lawn in good health. The domestic consumer is not the only offender on a flat rate system, the same applies to the garage, dairy and other industries if services are not metered. The installation of meters on a former flat rate system usually results in a drop in the consumption of 30 per cent to 50 per cent.

Halifax and Milwaukee

Let us take as an example the City of Halifax. In 1905, according to Dr. Ira P. MacNab, Manager of the Public Service Commission of Halifax, the population of the City of Halifax was 35,400 persons having 6,939 services. At this time Venturi Meters were placed on the main supply lines to the city and it was found that the consumption was 11,370,000 gallons per day, or 320 gallons per capita per day. At that time only 5 per cent of the larger services were metered and the city was faced with the necessity of a large capital expenditure for additional supply mains or a very drastic curtailment in consumption. It was decided to install meters on all services, which was completed on and about 1913. The consumption immediately went down. In 1949 the daily consumption of water was 10,980,000 gallons per day to a population of 100,000 people, or 109 gallons per capita per day.



METER TESTING and repair shop, Edmonton, Alberta
Industrial meters are handled by overhead conveyors

The same applied to the City of Milwaukee, Wis. This city was a leader among the larger American cities to undertake general metering. This work started in 1887 when the demand virtually equalled the capacity of the supply intake and pressures were necessarily reduced. Meters were then installed on many of the larger manufacturing and commercial premises to curtail waste of water and thus relieve low pressures in the distribution system.

This metering reduced the per capita demand from 113 gallons per day in 1887 to 102 gallons per day in 1888. At this time, less than 20 per cent of the services were metered. As the metering increased, the per capita demand reduced, reaching a minimum of 80 gallons per day in 1901 when 89 per cent of the services were metered. This was a per capita reduction of 30 per cent without making any allowance for the yearly increase in the per capita daily demand. Since that time, the per capita demand in Milwaukee has shown a normal annual growth in line with the experience of other meter American cities.

Waste Reduced at Yarmouth, N. S.

The reduction in consumption and waste of water by the use of meters increases the storage facilities directly in relation to the population of a municipality, making more water available for additional consumers, fire protection and industry. The installation of meters on all services will conserve water resources and prolong, usually for years, the necessity and expense of drilling new wells, going further afield to a new supply with pipe lines until such a time when it is absolutely necessary to supply the consumers with a legitimate amount of water for all purposes.

A very good example of this is the Town of Yarmouth, Nova Scotia. In 1945 the town was faced with the necessity of replacing 8½ miles of pipeline from supply to pumphouse at a high cost, plus the possible necessity of additional supply. The situation was so serious that at times during the dry season water was not available for domestic or fire protection purposes in some sections of the town. It was decided to install meters on all services. The consumption immediately went down. Meters enabled the town to carry on supplying water

for every need for the past ten years, even with the addition of approximately 2,000 in population to that of 6,000 in 1945.

Meters do not limit the legitimate use of water. In practically all water departments a minimum bill has been established, allowing a fixed quantity per service to provide sufficient water for all purposes during the billing period, based usually on a family of four. All above this is charged for, based on the cost of production and delivery of water. In practically all municipalities, which have decided to meter, the public is opposed to the idea, feeling that it is going to be penalized for the use of water for legitimate purposes. This is not the case. The amount supplied with the minimum bill takes care of this. The wasteful consumer pays. The meter is the "Policeman of the Water Works," on duty at all times.

Controlling the consumption and the waste of water by the use of water meters will reduce the cost of operation of the sewage disposal plant. With less sewage to treat, less capacity will be required, less power used for pumping, making for a more economical operation. If a sewage plant was to be built to take care of 150 gallons per capita per day on a flat rate system, its capacity would be much greater than it would be to take care of 100 gallons per capita per day on a metered system. This would add additional burden to the tax rate.

St. Leonard, N. B.

By reducing the waste of water, more water is made available to each consumer when it is required. Using as a very good example, the town of St. Leonard, New Brunswick, having a population of 1,400 with 236 services. In 1950 there were times in the dry season when the water supply was exhausted. Meters were installed on or about that time and ample water has been available since, even with the addition of 20 to 30 new services, including a regional high school. This is a good percentage of increase in population for a town of this size. Master meters are not used on the supply, therefore consumption figures are not available.

Sudbury, Ont.

It is no doubt every water works engineer's desire to serve the greatest number of people with the least capital expenditure. This can only be accomplished by the use of meters controlling the consumption and enabling the water works to operate on a businesslike basis, decreasing the cost to each and every consumer. According to a report by R. H. Martindale, Water Works Superintendent, Sudbury, Ontario, "Sudbury is confronted with the need for expanding its water works system and has undertaken the replacement of old mains. To reduce waste we are working towards 100 per cent metering. A few hundred meters are installed each year, and now our system is metered except for 25 per cent of the domestic services. Our water consumption is about 70 Imperial gallons per capita per day."

Every water works official will agree that it is necessary to collect from the consumer sufficient monies to pay for the operation, interest, sinking fund and depreciation. The installation of meters will conserve the capacity of an existing water system, keeping the capital investment at a minimum, and this eventually means less cost of water to each consumer and eventually a reduction in the tax rate.

A metered water system enables the water works officials to determine and check the unaccounted for water by comparing the grand total registration of all meters against the registration of the master meters on the supply lines.

Cali, Columbia

A further example of metering results is provided by George C. Bunker, Consulting Engineer at National Institute of Sanitary Works, Caracas, Venezuela. Cali, in Columbia, South America, furnished an example of the effectiveness of meters in reducing the waste of water. The installation of meters was started in April, 1933. On December 31, 1934, 71 per cent of the services had been metered and the average daily consumption had dropped to 5,820,000 gallons or 38 per cent less than it was during March, 1933, although 967 new services had been added during the lapse of twenty-one months. On August 31st, 1935, 80.5 per cent of the 8,420 services in use had been metered and the average daily consumption had dropped to 5,250,000 gallons or 44 per cent less than it was during March, 1933, although 1,607 new services had been added during the lapse of 29 months.

The benefits resulting from the reduction in waste and leakage of water in Cali were as follows: the construction of four filters was postponed; the addition of settled water to the filtered water was stopped; expense for chemical treatment of the water was reduced; there was a marked increase in pressure in the central section of the distribution system during the daytime; and filters operated at a normal rate.

Port Hawkesbury, N. S.

The advantages of water meters apply in the same manner to all water systems, large or small. In Port Hawkesbury, Nova Scotia, a water system having twelve consumers is completely metered. Some years ago one of the citizens had a good well and was approached by his neighbors to supply them with water, to which he agreed. After a year or so his well did not have sufficient capacity to supply the consumption. Someone mentioned to him that if he installed meters on each service he would have plenty of water. This was done and since then they have never been short of water.

The necessity of conservation of water is a real one in this rapidly growing Canada of ours, with industry and population on a rapid increase. This, the Government of Ontario has already recognized, and has appointed four members to study the feasibility of supplying water, on a master plan, to southwestern Ontario from the Great Lakes. Whatever the source of supply required for this growing area, the installation of meters will benefit the system by keeping waste at a minimum and assuring that water used is paid for on an equitable basis.

Vinton Bacon Goes to Industrial Assn. in Washington State

At the end of 1956, Vinton Bacon, Exec. Officer of the California State Water Pollution Control Board, resigned that position to become Executive Secretary of the newly formed Northwest Pulp and Paper Association. This association consists of 16 pulp and paper companies in Washington and Oregon and was formed to acquaint the public with the industry and to finance research in field of waste treatment and air and water pollution abatement.

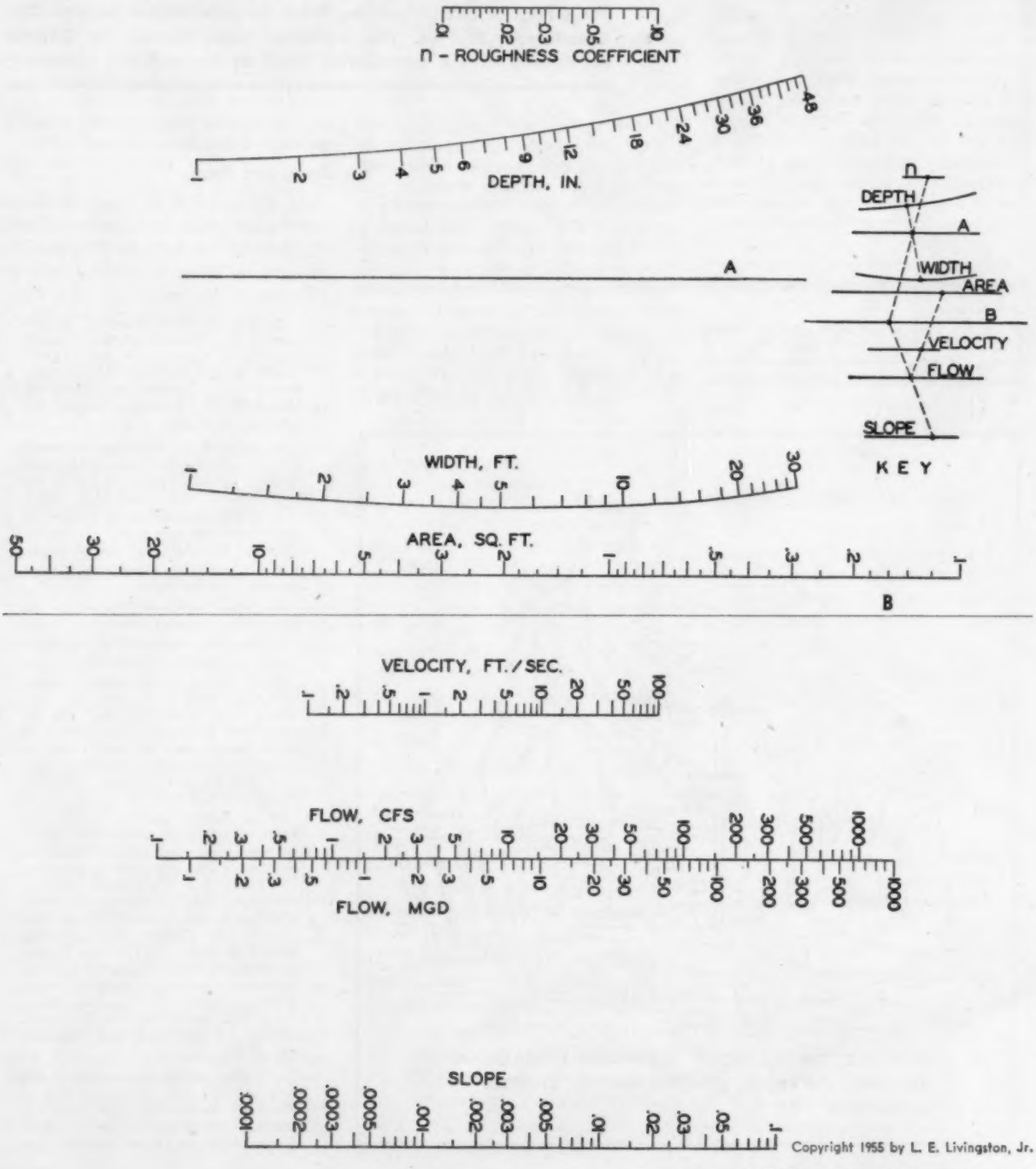
Bacon was the first full time Exec. Officer of the California State Water Pollution Control Board, a position he held for six years. He will be replaced by Paul Bonderson, who has been Exec. Officer of the Central Coastal Regional Water Pollution Control Board, one of nine regional boards in the state.

Flow in Rectangular Channels

by L. E. LIVINGSTON, Jr.
Dallas, Texas

THIS CHART provides a convenient solution of Manning's formula for open channel flow as applied to rectangular channels. A complete solution is accomplished in four steps, as shown in the key. To find the flow in a given channel, a line is drawn through Depth (of flow) and Width to pivot line A, a second line through A and Roughness to pivot line B, and a third line through B and Slope to Flow. If desired, Area is calculated separately, and a line drawn through Area and Flow to determine Velocity.

To find the required channel dimensions for a given flow, proceed in the reverse order. If velocity is a controlling factor, a line through Velocity and Flow determines the Area necessary. Then draw a line through Flow + Slope (assumed) to pivot line B, and a line through B and Roughness locates a point on A. By rotating a straightedge about this point, a suitable combination of Depth and Width is found. It may be necessary to select a different slope and repeat the calculation if the required area cannot be obtained.



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Why Operators Should Keep Good Water Plant Records

by WALLACE GRANT
Mr. Grant is Chemist of the West Virginia Water Service Co., Charleston, W. Va. The cartoons were drawn by George M. Keeney of the engineering staff of the author's company.

TO THE MAN operating a water treatment plant, keeping records of the operation is sometimes regarded as so much "paper work". Given a proper understanding of the purpose of adequate record keeping, however, this attitude quite likely will change, especially when the operator realizes that one of the primary reasons he should have written records of plant operation is for his own protection, in case of any controversy, unjust criticism, or in the event of an epidemic in the community.

Efficient operation of a water plant would be difficult, if not impossible, in the absence of proper records. Aside from systematizing and improving operation, records furnish information as to how a certain situation was handled in the past, together with how successful this method was found to be. When an expansion or improvement is needed in the plant, records furnish the basis of the plans; they also provide the information needed to justify the expansion or improvement to the governing body, whether a commission, city council, or board of directors. Records have a legal standing, in case of disputes which might get into the courts of law[1].

Ed Note: This paper comprised a lecture by Mr. Grant before the Virginia Water & Sewage Works Operator's Short School held at Va. Polytechnic Ins't., Blacksburg, Va.

Suggested Form

In 1930 an AWWA committee on purification data and forms offered suggestions on records [4], the important portions of which were as follows:

1. The entire monthly report should be made on a single sheet exactly 11 inches wide and of sufficient length to meet all requirements. The reports can then be folded 8½ by 11 inches in size for binding or filing.

2. A 2-inch binding margin should be left on the left-hand edge, and at least ¼-inch margin be left at the top, bottom, and right-hand edges.

3. The report should be printed or reproduced on thin paper or tracing cloth, so that (prints) can be made.

4. No printing should be put on the back of the sheet.

5. Title should be placed in the upper right-hand corner.

6. Remarks should be made in the space to the left of the title.

8. In filling in the forms, entries under the head of *B. coli*, the fractional form should be used, the denominator indicating the number of tubes tested, and the numerator indicating the number of tubes positive. (In current practice the term "coliform bacteria" is used).

9. In making annual reports, the same general arrangements should be used, but the report should be separated into two sheets, grouping the physical and chemical data on one sheet, and that relating to microorganisms and bacteria on another sheet. The spacing and lettering should be larger than on the regular monthly report so that photographic reproductions can be made. Monthly averages should be reported. Maximum and minimum results should be for the maximum and minimum day only.

11. The committee realizes the impossibility of recommending a standard form that will meet the needs of every city. Each city finds it desirable to record certain data

that would be of no particular value to other cities, but in order to compare the work of one filtration plant with another it is very desirable, insofar as possible, that each city preserve the same order in making reports.

Types of Records Needed

The size of the water treatment plant will largely determine the form in which records are kept. In a small or medium-sized plant the following are useful:

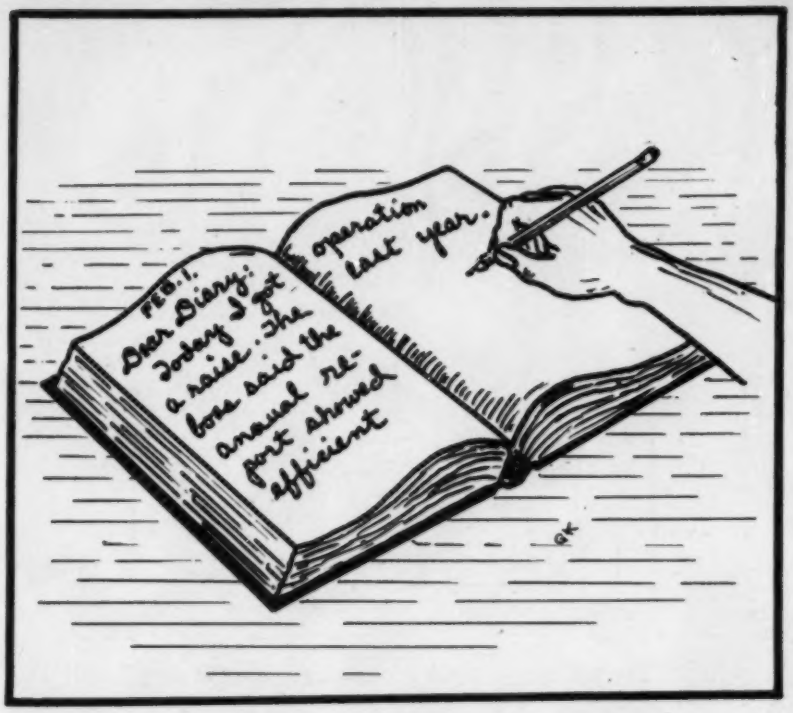
1. Daily log of filter operation, chemicals used, and such tests of water quality as determined by the operators.
2. Daily pump operation record.
3. A record of tests for residual chlorine, every hour or every two hours. The daily average is entered on the monthly report.
4. From the above a monthly or weekly report should be prepared for the record and to send to the State Department of Health.
5. A diary in which is recorded such information as will not readily fit any of the above forms.
6. An annual report.
7. A permanent file of instruction books, etc.

A good way to adapt forms for use in a plant is first to prepare them by mimeograph, or other method of rapid and easy reproduction, then use them a while, making corrections according to experience, before final forms are printed[1].

Daily Log and Pump Record

The daily log should show the amount of water pumped or filtered, the amount of water used in washing filters and for other plant use, the amount of chemicals needed for purification, the quality of the raw water, and the quality of the water leaving the plant[2]. It also should show when each filter was placed in operation after washing, which filters were washed, etc.

The results of daily tests made in the plant laboratory furnish a valuable record. The tests on raw water are helpful in adjusting the treatment of the water. Furnished water test results often will show the need for adjustment of chemical feeds in order to get the water quality closer to the ideal. For instance, a threshold odor test will show the need for improved odor control. Laboratory tests also furnish a record of water quality, which is both a protection to the water utility and satisfies the demand made by many water consumers. Calls often



are received from water consumers who wish to have a record of the water temperature, water hardness, and other mineral characteristics.

The daily record of chemicals used is the basis of all calculations of chemical cost per million gallons of water. Daily meter readings of power used and gas used enable the operator to keep a close check on the expense incurred by these items. The pump record should include the time each pump was started and stopped and the total hours each pump was used.

It is important that reports of a plant be studied at intervals to compare the efficiency with which the plant is operating[3].

The Diary

In the diary certain data should be kept which are essentially of a somewhat out-of-routine nature. The diary very properly could contain any or all of the following items:

1. Occasional numerical data and measurements, such as wash water rise on filters.
2. Repairs to a pump, valve, chlorinator, etc., or the replacement of any item in the plant.
3. Visits by officials of the company, water department, health department, labor department, or others, together with their remarks and impressions.
4. Start of any new operation, such as, for example, fluoridation.
5. Record of droughts or floods, and their effect on the plant.
6. Unusual difficulties in treatment, such as strong odor and taste in the raw water, and the measures found best to control them.

Monthly or Weekly Report

All important data from the daily log sheet and laboratory results should be included in the monthly report or the weekly report. These should include as many of the following items below as are available at the individual plant:

1. Water pumped or filtered.
2. Hours of operation daily.
3. Number of filters washed, together with hours filters operated between washes.
4. Wash water used.
5. All chemicals (in pounds) applied to water for each day's operation, together with the calculated dosage in parts per million, pounds per million gallons, or grains per gallon.
6. All chemical determinations, such as hardness, pH value, residual chlorine, etc.
7. All physical observations, such as turbidity, temperature, etc.
8. A complete record of all bacteriological examinations during the period.

Annual Report

If an annual report is prepared, it should show a compilation of the information in the monthly reports, with the average values of each for the year, together with the maximum and minimum days.

A brief narrative portion should be included which lists important events for the year, such as major improvements, new operations started, droughts, floods, and any other items of interest which, if not recorded here, could result in a frantic search for facts concerning them in later years. This could be a summary of items entered in the diary during the year. After a few years, items in a diary are quite difficult to find.

Permanent Records

Every plant, whether a large one or the smallest, should have a carefully preserved file of all instruction books, drawings, and other information furnished with each piece of equipment in the plant. It is surprising how many times a plant is visited where no instruction book is available for a piece of equipment purchased some years ago. Where this condition exists, usually a duplicate instruction book can be obtained from the manufacturer, often at no cost.

It is also a good plan to have name-plate data from various equipment items, collected, carefully copied, and placed on file at both the plant and the office.

Summary

Written records of water plant operation protect those operating the plant from unjust criticism, improve the operation by making available a check on efficiency, provide information on which expansion or improvements may be made, and have a legal standing should any dispute get into a court of law.

The American Water Works Association has, by committee, suggested standard forms for monthly and annual reports.

Suggested records to be kept by the water plant are as follows:

1. Daily log of filter operation, pump operation, and water quality tests.
2. Monthly or weekly report.
3. Diary.
4. Annual report.
5. Permanent file of all instruction books, name-plate data, and other information furnished by manufacturers of plant equipment.

Far from being just "paper work", careful records of water plant operation are essential for proper operation of a water works.

References:

1. Hirsch, A. A., "Manual for Water Plant Operators", Chemical Publishing Co. (1945).
2. Norcom, George D., and Broun, Kenneth W., "Water Purification for Plant Operators," McGraw-Hill Book Co. (1942).
3. Hopkins, Edward S., "Water Purification Control," The Williams and Wilkins Co. (1932).
4. AWWA Manual, "Water Quality and Treatment" (1950).

Dr. Heukelekian Becomes Chairman, Dept. of Sanitation at Rutgers University

Dr. H. Heukelekian, for many years in the Department of Sanitation at Rutgers University and Professor of Research Engineering at the University has been made chairman of the Department, as successor to former chairman Dr. Willen Rudolfs, retired.

Dr. H. E. Orford, who served as interim chairman of the Department of Sanitation, will continue with the Department in research and teaching activities.

Dr. Heukelekian is well known for his investigative work in sewage and waste treatment and in technical association work. He is chairman of the Committee on Research of the Federation of Sewage and Industrial Wastes Associations.

California Schedules Water Plan Legislation for '57

Resulting from a nine year study of California's water resources, a master guide will be presented to the state Legislature for enactment in 1957. The plan proposes proper allocation of Colorado River Water, and proper development of water within the state both of which are necessary to the support of the "ultimate" development of the state's land area. Domestic, agricultural, industrial, recreational and other water uses are included.

They say: "To keep on the up-grade a man must stay on the level."

Sanitary Engineer Becomes President Elect of A.P.H.A.

Roy J. Morton, former Chief sanitary engineer of the Tenn. Dept. of Health and more recently supervisor of Waste Disposal, Oak Ridge, National Laboratory, Oak Ridge, Tenn. has been elected president-elect of the Am. Public Health Association.

Such an election means that Mr. Morton will become the next president of the Am. Public Health Assn., an honor rarely accorded a sanitary engineer member in this association, which is so predominately an association of medical officers of public health.

AERIAL sewers of long length pipe on piers

Sewers Take To The Air

To effect economical construction at Gainesville, Georgia

GAINESVILLE, GA., is in the midst of one of the important chicken raising sections of the Southeast. It is also near Buford Dam being built on the Chattahoochee River, by the U. S. Corps of Engineers.

The dam will bring many advantages to the region, but with it came one disadvantage. Lake Lamier, formed by the dam, caused backwater to fill the ravines and lowlands around Gainesville and inundated the existing sewer outfalls as well as the water treatment plant.

The only solution was to build new sewer outfalls and a new water plant. At the same time the lake had to be protected from contamination and the public health preserved. This led to the decision to construct a sewage treatment plant for complete treatment of domestic sewage and poultry processing wastes.

CLOSE-UP of water tight flange connection.

by W. E. McFEE
Supervisor, Information Service
Armco Drainage & Metal Products, Inc.
Middletown, Ohio

The country surrounding Gainesville is somewhat rugged, which necessitated a number of aerial sewers to hold down the cost. The alternative was additional underground lines running around the saddles of the ravines. This would have meant much longer sewers and more head to hold the proper grade for gravity flow.

Another problem was the selection of economical pipe material to span the many gullies, some as deep as 60 feet. Armco Steel pipe was chosen and laid on 50-foot clear spans. Steel "A" frame piers on concrete footings were designed to support the pipe. The 50-foot long sections were easily placed on the piers with a crane and the joints arc-welded after the pipe was placed on grade and alignment.

Asbestos-bonded corrugated metal pipe was used on the shorter spans, being placed on concrete block piers spaced according to pipe diameter and gage of metal. Concrete footings for all piers were raised above the high water level of the lake.

The asbestos-bonded pipe was placed by hand labor. Joints were bolted together with a special water-tight flange provided on each section of pipe. Only a wrench was needed. This was the first use of flange connections on corrugated aerial sewers in the state of Georgia.

The use of steel and corrugated pipe proved a most logical solution to a difficult problem. The long lengths required fewer joints while the longer pier spacing brought ease of installation and sound, economical construction.

The project was completed in mid-1956. Engineers for the job were Robert and Co. Associates, Atlanta, Ga. F. E. Blackburn was resident engineer.

SEWAGE WORKS PRACTICES

Air in Sewage Treatment Plants

The Sixth of a Series of Articles

by THEODORE JAFFE

Mr. Jaffe is Professor of Civil Engineering, Alabama Polytechnic Institute, Auburn, Ala. In this series of articles for the practical sewage treatment plant operator, he discusses matters of interest generally overlooked in the press of routine duties.

MANY sewage and industrial waste treatment processes involve the use of air. The most commonly known is the activated sludge process, which was discussed in the previous article of this series[1]. There are, however, many other uses for air in waste treatment. This article will discuss some of these, which may be listed as follows:

1. Pre- or post-aeration.
2. Artifical reaeration of streams.
3. Agitation or mixing.
4. Plain aeration.
5. Oxidation.
6. Flotation.
7. Grit separation and removal.
8. Miscellaneous uses, particularly with industrial wastes.

Pre-Aeration

The term "pre-aeration" applies to the use of air ahead of the main, standard processes of primary or secondary treatment. It is usually employed for any of four reasons: (a) odor control, (b) reduction of the organic load on the subsequent treatment units, (c) increase in the dissolved oxygen content of the raw sewage, and (d) grease removal.

In any application of pre-aeration that aims at one of these four objectives, the other three usually go along. When air is blown through a septic, odorous, raw sewage the septicity is reduced, odors are reduced, some degree of B.O.D. reduction is achieved, and suspended solids and grease removals are increased. The benefit obtained from pre-aeration depends on the characteristics of the waste, the detention time, and the air input, up to certain limiting values.

It has been suggested that detention times be at least 30 to 45 minutes at design flows, with an air input of 0.1 cu. ft. per gal. for a minimum. Where grease removal alone is the objective, somewhat shorter aeration periods, some as low as 5 min., have been used. It is regrettable that so little actual plant data on pre-aeration are available although two articles [2], [3] are available for those interested in further reading. One type of pre-aeration and sedimentation unit is shown in Figure 1.

Pre-aeration reduces odors by introducing air into the waste, thereby reducing the anaerobic conditions causing the odors, or by supplying air to keep borderline wastes from becoming septic and smelly. This is especially useful in treatment plants hav-

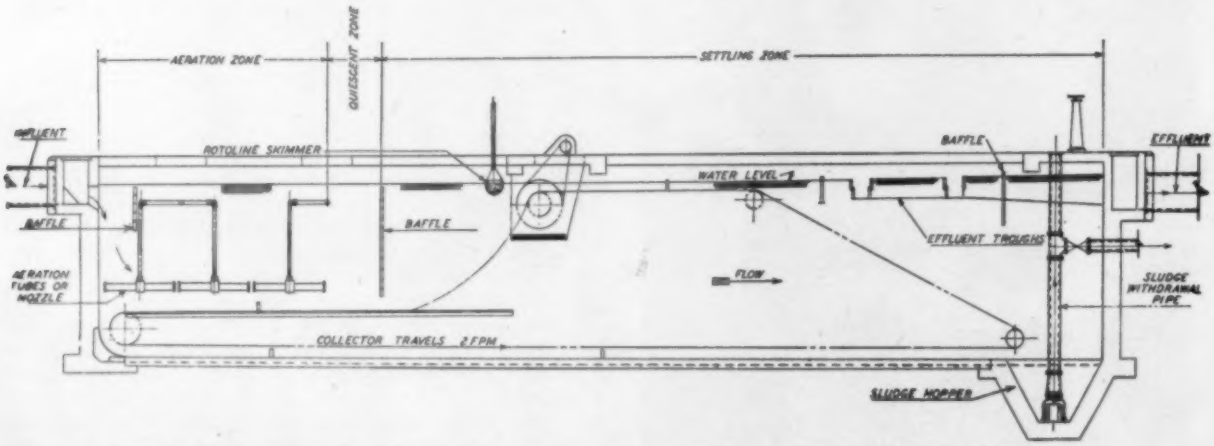


Fig. 1. LINK-BELT pre-aeration unit provides aeration and settling in same tank with quiescent zone between.

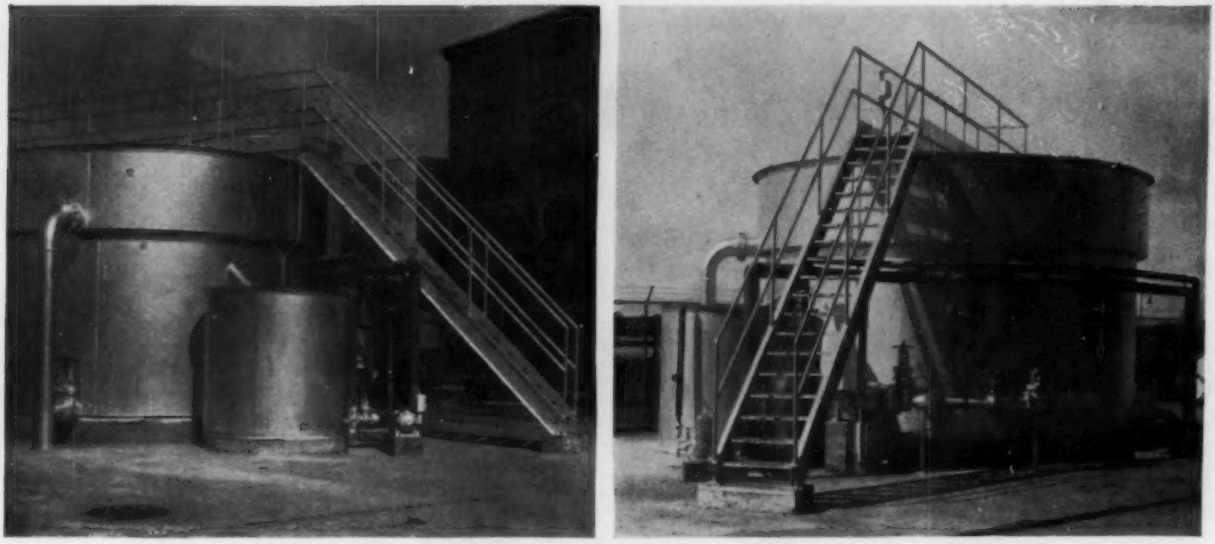


Fig. 2. TWO VIEWS of Gibbs flotation unit located at Proctor & Gamble Co. at Quincy, Mass.

ing too long a detention time in primary tanks; for example, during low flows at night. If these primaries are followed by filters, and the waste is allowed to become odorous, it will be especially bad at the distributors of the filter. Pre-aeration will help to reduce these odors. It must be cautioned though, that improper use of pre-aeration on a septic sewage may increase odors at the point of application of the air. This has often led operators to abandon pre-aeration as worthless, whereas improper operation was at fault.

A rather unusual method of odor control has been reported from Norway[4]. It is based on the principle of floating an aerated fresh water on the surface of the sewage. The method of application is similar to that of spraying tanks to keep the froth down. The fresh water, it is claimed, does not mix with the sewage, but floats on the surface. Continuous withdrawal from the surface gives a "floating cover" effect, which inhibits odorous gases from being discharged into the atmosphere.

The mechanisms by which pre-aeration reduces the B.O.D. and improves suspended solids removals will be discussed in another section, as will grease removal.

Post-aeration is not too commonly employed in domestic sewage plants. It has been applied to Imhoff tank effluents, primary, and secondary effluents to increase the dissolved oxygen content before discharging to the stream. A modification of post-aeration used in some plants is to aerate return activated sludges, or recirculated filter effluents. The benefits obtained here are dependent on the factors previously mentioned.

Artificial Reaeration of Streams

Perhaps the foremost reason for waste treatment is that of assisting a stream or river in the stabilization of the polluting material. For the organisms in the stream to do this job properly (that is, aerobically), the stream must have a certain dissolved oxygen supply available. The oxygen is used by the organisms to convert the unstable polluting material into non-objectionable end products that have no further oxygen demand. If the stream does not have sufficient oxygen decomposition of the polluting material will still occur; but it will be done by a different group of organisms—the anaerobes—which do not need dissolved oxygen.

What's wrong with this? The result of this anaerobic activity is a foul-smelling, bad appearing stream having sludge deposits on the bottom, no oxygen in its waters, and eventually no fish life. The main purpose in treating wastes is to prevent this condition from occurring by performing some of the stabilization in the treatment plant and thus relieving the stream of its burden.

Some streams, however, are in such poor condition that enough assistance cannot be offered, even after treatment. For such conditions there is another helpful device. By either changing the stream's characteristics or by blowing air into the stream, Nature can be assisted in its battle against pollution. In some instances it has been found helpful to make shallow rapids or falls in the stream so that reaeration may proceed more rapidly. In other situations attempts have been made to place diffusers in the stream and blow air (oxygen) into it. This is called "accelerated reaeration"[5] and has been tried with considerable success in Wisconsin, where spent sulfite liquor was discharged to a river.

Agitation or Mixing

When chemicals are added to wastes for solids removal, thorough mixing and agitation are essential for economical operation. This may be accomplished by mechanical stirrers, or by air. When air is used, a secondary effect may be obtained if desired. This is oxidation. Many sewage plants use air for mixing the chemical coagulants with the sewage before sedimentation. Some plants use air for mixing iron conditioning salts with sludge before vacuum filtration. Both of the procedures, it is claimed, are effective.

The use of air primarily for agitation will be discussed in more detail under the section on flotation. Air for mixing and oxidation has been used for treating many industrial wastes. Some examples of this use of air can be found in the metal industries. One of the major wastes in this industry is that from the pickling operation. This is an acid waste containing iron in its divalent form (ferrous iron). By means of lime neutralization and air this ferrous iron is converted to ferric hydroxide. The oxidation may be accomplished directly in the mixing tank, thus achieving agitation and oxidation[6] or after conversion of the iron to ferrous hydroxide, by aeration on a cascade baffle[7].

Plain Aeration

Most plant operators have heard about activated sludge. In this treat-

Fig. 3. CHAIN-BELT Rex Float-Treat unit in meat packing plant installation for recovery of fat and grease.

ment process air is blown through a mixture of sewage and a flocculent mass of microorganisms called activated sludge. The organisms living in the sludge purify the waste, and after separation in a secondary settling tank are returned to the process. In this manner about 95 percent of the B.O.D. and suspended solids are removed from the waste. The heart of the process is the activated sludge.

However, it has long been known that aeration without the production of an activated sludge is also beneficial in B.O.D. and suspended solids removals. Although the efficiency of this plain aeration process is not as high as that of activated sludge, it does have merit. It is particularly useful with some types of industrial wastes.

Plain aeration accomplishes waste reduction mainly through a greater removal of suspended solids. By better mixing and bringing the solids into more intimate contact, more solids can be removed in subsequent sedimentation. It is mainly due to this increased solids removal that B.O.D. removals are also increased, since the solids have a B.O.D. There is no doubt, though, that some of the B.O.D. is removed by chemical oxidation.

In some unpublished work this author did with citrus concentrate wastes, B.O.D. reductions were achieved by plain aeration due to the oxidation of peel oils in the waste. Other industrial wastes have similarly found aeration helpful; for example, oil refinery effluents aerated for 6 to 12 hours had the B.O.D. removed to the extent of 50 per cent of that achieved by activated sludge[8]. The milk and milk-products industry has applied plain aeration in several instances with considerable success[9] [10]. Use of pre-aeration in the pharmaceutical industry is described by Hilgert[11].

Another development along these same lines is that of aeration in the presence of non-flocculent or dispersed growths. The principle used here is similar to activated sludge, but differs in two main respects: (a) The organisms cultivated are different and do not live in zoogleal masses; therefore (b) part of the liquor, after settling, is returned to the aeration unit instead of the sludge. Since the organisms live mainly in the liquor, the new waste entering the aeration unit is constantly seeded, and stabilization of the waste takes place. This method of waste reduction has been used by the pulp and paper industry in its waste disposal problems[12] [13].

Oxidation

Although oxidation is involved to some degree in any application of air to waste treatment, some instances are particularly aimed at direct oxidation of the waste. It was previously mentioned that ferrous iron was oxidized to ferric in the metal industries. The tanning (chrome) industry uses air for the direct oxidation of its sulfide liquor wastes from the liming process[14]. The cemi-chemical paper mills have recently tried direct oxidation of wastes at temperatures above 525°F. and at 1,500 p.s.i.g. air pressure[15].

For the reduction of oxygen consuming properties of organic wastes, the Du Pont company has developed a patented process called "Catalytic Oxidation"[16]. In this process (originally developed for vapors) the waste is passed over a catalyst in the presence of air or oxygen, and the organic matter is oxidized to harmless end products. For other than vapors, it is presumed that suspended solids would first be removed.

A catalyst is a chemical that speeds up reactions without being consumed in the process. This then is a form of accelerated oxidation. The Du Pont people found that the oxides of copper, chromium, manganese, nickel, and cobalt were most effective. These would reduce the oxygen consumption of the waste by as much as 99 per cent.

Most methods of aeration are primarily concerned with the effects produced by the oxygen in the air. At the usual temperatures and pressures, air contains only about 21 per cent (by volume) oxygen; that is, for every 100 cubic feet of air pumped into a system, at best there can be only 21 cubic feet of oxygen, the rest (79 per cent) being unwanted gases. This is not very efficent, and quite expensive. Various persons have attempted to use pure oxygen in place of air, but have found that this was not satisfactory for several reasons, one of which was the expense. Another method, that of "tonnage oxygen"[17], has been suggested to reduce the cost.

Tonnage oxygen is oxygen gas of 95 per cent purity which is produced at a high rate to be used continuously at or near the site of its production. The gas is not under pressure, thus eliminating the need for compressors, containers, reducing valves, etc. The major advantage of tonnage oxygen is the greater solubility of oxygen compared to air, in water. Normally, water (or sewage) exposed to air is saturated at about 8 ppm. However, when the water or sewage is in contact with oxygen, at the same temperature and pressure, it can hold about 40 ppm. If the pressure is increased to that corresponding to 17 feet of head, the saturation level increases to 60 ppm. This means that more oxygen (the working ingredient of air) can be placed into the waste and more stabilization can be accomplished. Now that tonnage oxygen can be produced more readily and economically, it may be used to a greater extent in waste treatment works.

Flotation

The flotation process for separating various components of a mixture has

long been used by industry; for example, coal, metals, ores. It is, however, relatively new in waste treatment. Before discussing the methods and units it might be advisable to review a little theory.

Solids can be separated from the carrying liquid either by settling due to gravity, or by floating to the surface if they are lighter than the liquid. These types of separation are commonplace experiences; sand being heavier than water will settle to the bottom, oil being lighter will float to the surface.

This tendency to settle is measured by "specific gravity," which is the relative weight of a substance compared to water, taken as 1.00. Anything heavier than water has a specific gravity greater than 1.00 and will settle; anything lighter has a specific gravity less than 1.00 and will tend to rise to the surface. These facts explain natural flotation.

The problem in wastes treatment is to cause the particles just slightly lighter than water to rise more rapidly and effectively, and to try to make some of those heavier than water also rise to the surface, where they can be skimmed off or collected. How can this be done? By attaching a light material to or combining it with these particles, the total specific gravity can be decreased so that the new mixture will rise to the surface. One of the materials that can be used is air.

There are two types of flotation—natural and induced. The natural flotation process has been observed by most operators any number of times; for example, in grease traps or primary units, as oil sleeks, as light solids coming over the weir of a settling basin, etc.

The induced type has taken three forms. In one of these, diffused air is merely blown into the waste, the air bubbles attach themselves to the solids particles, and these then rise to the surface. This is the older type of flotation, and has been used effectively in many situations. As mentioned previously, this occurs in most pre-aeration units and accounts for the increase noted at many plants in suspended solids removals in the subsequent sedimentation tanks. It should be pointed out again that any aeration process is bound to yield a additional benefit in D.O. content of the waste.

By far the greatest use of this simple type of flotation has been for industrial waste treatment; for example, grease recovery from packinghouse wastes. As more units came into use, a modification was suggested.

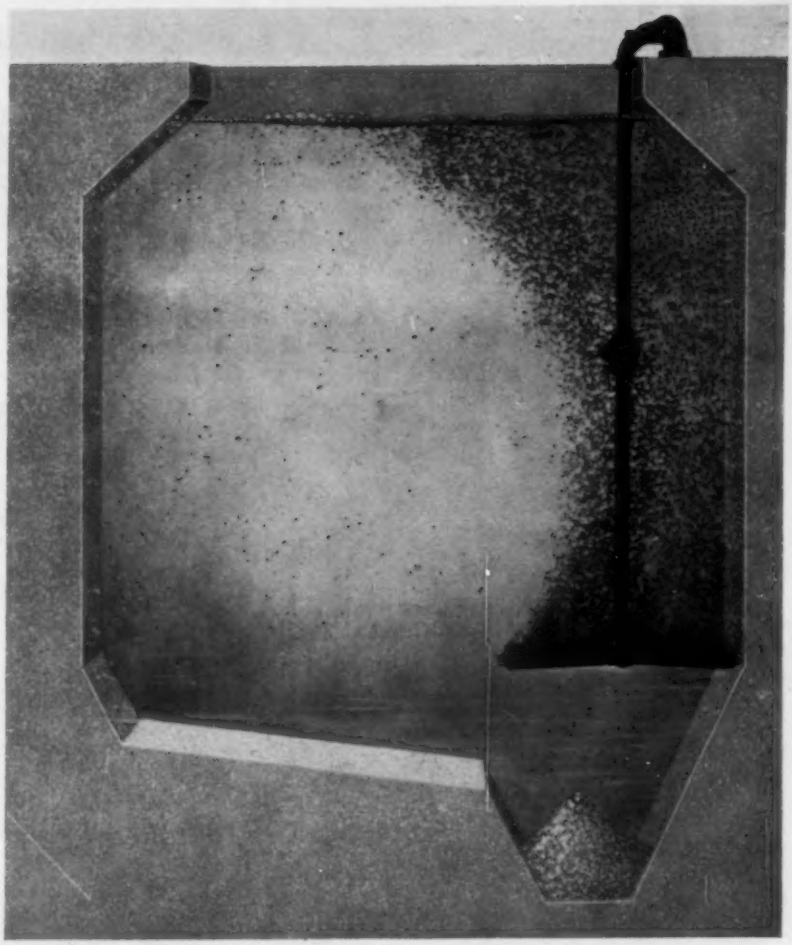


Fig. 4. AER-DEGRITTER by Chicago Pump Co., settles and cleans grit, but keeps organic matter in suspension.

This consisted of adding chemical coagulants to the air-waste mixture. As a result, still greater removals of suspended solids were possible, especially of the very light and very fine solids. The air is used both to mix the coagulants and waste and to increase the flotability of the coagulated solids. Industry has used this method successfully in many instances; for example, on wastes from oil refining, citrus canning, cosmetic manufacture, meat packing, wool scouring, etc.

The third and most recent modification involves compressing the air, introducing it under pressure into the waste in a closed chamber or tank, and then taking the mixture into a low-pressure tank. In the latter tank, due to the lower pressure, the air tends to come out of solution in very fine bubbles. These small bubbles of air are more effective in combining with the solids and then carrying them to the surface, where they can be removed by skimming. This process can, of course, be used with chemical coagulants to further increase solids removal.

It should be pointed out that effluent from any flotation-type unit is usually withdrawn below the solids layer, as opposed to the gravity-type sedimentation tank. Furthermore, the capacity of flotation units depends on the rate of flotation, rather than the rate of settling. It is claimed that this results in smaller space requirements and shorter detention times. When a laboratory-size flotation unit was used on machineshop wastes it was found, in addition to the foregoing advantages, that "about 40 per cent less coagulant was required and produced a scum of materially less volume than that of the sludge resulting from sedimentation"[18].

There are several air flotation units manufactured commercially. Among these are the Gibbs unit developed by the F. S. Gibbs Co., Boston, Mass. (Fig. 2); the Rex Float-Treat unit manufactured by the Chain Belt Co., Milwaukee, Wis. (Fig. 3); the Colloidair separator developed by Bulkley, Dunton Processes, Inc., New York, N. Y.; the Vacuator developed

by the Dorr Company, Stamford, Conn., and others.

Grit Separation and Removal

Air diffusion has been used to effect grit removal from sewage in tanks very similar to those used for activated sludge treatment. The air diffusers are usually set higher than in activated sludge tanks and above a sump so that the grit can be collected and removed. Due to the rolling (spiral) motion of the liquid in the tank, the grit is rolled toward the sump while the organic solids are kept in suspension and pass out onto the next treatment unit (Fig. 4). As the grit is rolling toward the sump, it also is washed so that very few organic solids are removed with the grit. The recommended tank velocity has been stated as 2 feet per second. This velocity moves the grit to the sump, where it drops out of circulation, but keeps the organic solids in suspension. The detention time is about 1 minute[3]. The settled grit can then be removed by a clamshell bucket, an air lift, or a jet pump. Because the grit is fairly free of organic material, the air lift or jet pump discharge need only be drained before disposal.

Miscellaneous Uses

Aeration and vacuum flotation have been used in other ways by industries for solution of treatment or disposal problems. In addition to those instances already mentioned, the following are of interest.

Paper mills producing tissue products have recovered 65 per cent of suspended matter by vacuum flotation.

A soap and edible-oil plant found air flotation effective in cleaning up "dirty" cooling water for re-use as a water conservation method[19]. The fresh water requirements for laundering with soap were reduced 87 to 95 per cent by flotation and chemical coagulants[20]. Many other situations are described in the various journals.

Another recent idea for the aeration of wastes is that of "aerobic digestion." This process is basically activated sludge, except that there is practically no waste sludge. After passing through the aeration tank the mixed liquor is settled to obtain the clarified and stabilized effluent and almost all of the settled sludge is returned to the aeration tank.

This process assumes that most of the organic matter in the waste can be taken into the bacterial cells for nutrition and growth. Provided sufficient oxygen is available, these organisms then consume the material and aerobically oxidize it to stable, non-oxygen demanding end products. Anyone familiar with the carbon, nitrogen and sulfur cycles can readily understand this. It is basically nature's way of waste disposal where sufficient oxygen is available (as, for example, in a "clean" stream).

The dairy industry has found this aerobic digestion process a most satisfactory solution to waste disposal problems. An article by Hauer[21], and the references therein, gives some idea of design criteria, operation, and results achieved in various dairy plants.

Aerobic digestion seems to have been successful in treating the wastes from a fine chemical plant. This is described in an article by Dryden et al[22]. On the basis of pilot plant studies they achieved a 55 to 60 per cent reduction of sludge solids in 4 to 6 days through aerobic digestion.

Some of the uses of air for waste treatment have been discussed in this article. In addition to these, air is used in sewage treatment plants for mechanical assistance; for example, air-operated metering units, air lifts, etc. These will be discussed in a future article on instrumentation. The next article in this series will be on methods of odor control.

References:

1. Jaffe, T., "Recent Developments in Activated Sludge Process," *Water & Sew. Works*, 103:9:428 (1956).
2. Roe, F. C., "Pre-Aeration and Air Flocculation," *Sew. & Ind. Wastes*, 23:2:127 (1951).
3. Kappe, S. E., and Neighbor, J. B., "Some New Developments in Aeration," *Sew. & Ind. Wastes*, 23:7:833-838 (1951).
4. Knoedler, E. L., "Sewage Treatment in Scandinavia," *Water & Sew. Works*, 100:3:125 (1953).
5. Tyler, R. G., "Solving the S.W.I. Problem," *Sew. Works Eng.*, 20:6: 292, 312 (1949).
6. Heise, L. W., and Johnson, M., "Disposal of Waste Pickle Liquor by Controlled Oxidation and Continuous Lime Treatment," *Sew. & Ind. Wastes*, 27:2:192 (1955).
7. Hendel, F. J., and Stewart, V. T., "Flow-Through Treatment of Metal Industry Wastes," *Sew. & Ind. Wastes*, 25:11:1325 (1953).
8. Coe, R. H., "Bench-Scale Biological Oxidation of Refinery Wastes with Activated Sludge," *Sew. & Ind. Wastes*, 24:6:745 (1952).
9. Neill, D. G., "Waste Treatment Facilities of the Belle Center Creamery and Cheese Co.," *Proc. Fourth Ind. Waste Conf.*, Eng. Bull., Purdue Univ., 33:4:45 (1949).
10. Johnson, W. Scott, "An Aeration Plant for Milk Waste Disposal," *ibid*, p. 54.
11. Hilgart, A. A., "Design and Operation of a Treatment Plant for Penicillin and Streptomycin Wastes," *Sew. & Ind. Wastes*, 22:2:207 (1950).
12. Rudolfs, W., and Nemerow, N. L., "Rag, Rope and Jute Wastes from Specialty Paper Mills," *Sew & Ind. Wastes*, 24:8:1005 (1952).
13. Rudolfs, W., and Amberg, H. R., "White Water Treatment," *Sew. & Ind. Wastes*, 25:1:70 (1953).
14. Foster, W., "Discussion on Trade Waste Purification Plant," *Jour. and Proc.*, Inst. Sew. Purif., Part 2, p. 98 (1950).
15. Anon., "Latest Developments in Zimmerman Recovery Process," *Paper Trade Jour.*, 139:46:32 (1955).
16. Green, R. V., and Moses, D. V., "Destructive Catalytic Oxidation of Aqueous Waste Materials." *Sew. & Ind. Wastes*, 24:3:288 (1952).
17. Okun, D., "Tonnage Oxygen," *Water & Sew. Works*, 100:9:376 (1953).
18. Haseltine, T. R., "Discussion of paper on Machine Wastes," *Sew. & Ind. Wastes*, 27:2:205 (1955).
19. Sessler, R. E., "Waste Water Use in a Soap and Edible-Oil Plant," *Sew. & Ind. Wastes*, 27:10:1178 (1955).
20. Wollner, H. J., et al., "Clarification by Flotation and Re-Use of Laundry Waste Water," *Sew. & Ind. Wastes*, 26:4:509 (1954).
21. Hauer, G. E., "Successful Treatment of Dairy Waste by Aeration," *Sew. & Ind. Wastes*, 24:10:1271 (1952).
22. Dryden, F. E., et al., "High-Rate Activated Sludge Treatment of Fine Chemical Wastes," *Sew. & Ind Wastes* 28:2:183 (1956).

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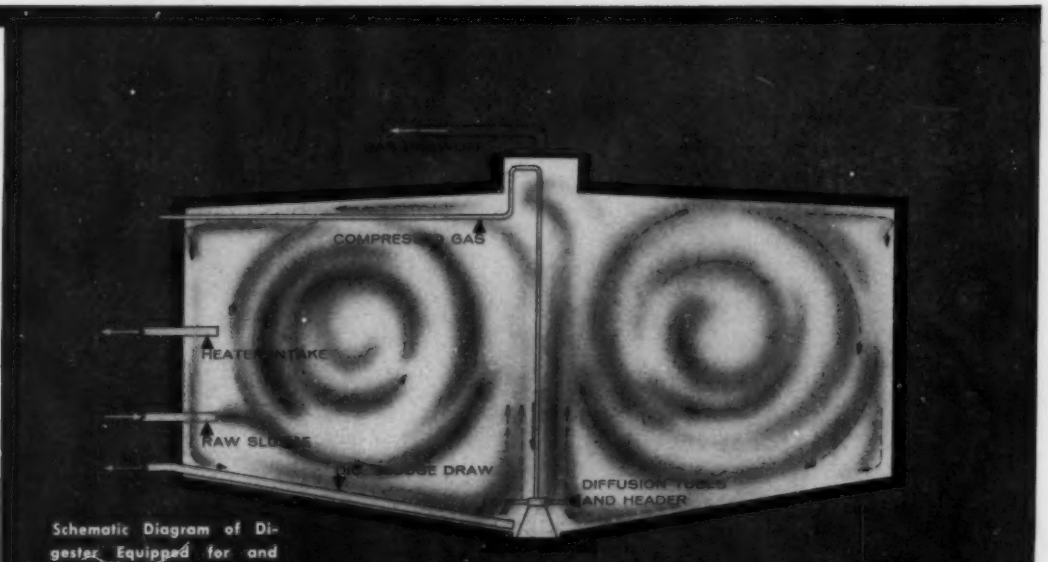
through exclusively highest solids loading with "CRP*"

*Catalytic Reduction Process



Schematic Diagram of Digester Equipped for and Operation Under CATALYTIC REDUCTION PROCESS.

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†*Exclusive of sludge storage volume that may be required by subsequent disposal methods.*

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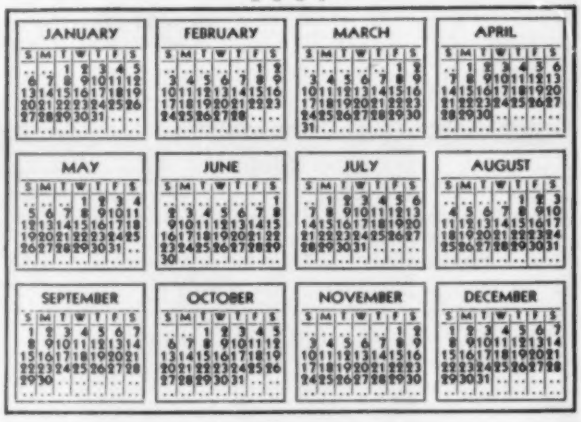


Feb. 6-8—Indianapolis, Indiana (*Sheraton-Lincoln Hotel*)
INDIANA SECTION, A.W.W.A., Secy., Robert J. Becker, Indianapolis Water Co., 113 Monument Circle, Indianapolis 6, Ind.

Feb. 13-14—Portland, Maine
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Feb. 14—Newark, N. J. (*Hotel Essex House*)
NEW JERSEY SECTION, A.W.W.A., Secy., Albert F. Pleibel, 683 Prospect Street, Maplewood, N. J.

Feb. 18-21—New York, N. Y. (*Waldorf-Astoria Hotel*)
NATIONAL COUNCIL FOR STREAM IMPROVEMENT, Exec. Secy., Russell L. Winget, 271 Madison Avenue, New York 16, N. Y.

Feb. 18-22—Jackson, Miss. (*Hotel Heidelburg*)
AMERICAN SOCIETY CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th Street, New York 18, N. Y.

Feb. 21—Boston, Mass. (*Hotel Statler*)
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston, Mass.

Mar. 3-6—White Sulphur Springs, Va. (*Greenbrier Hotel*)
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Secy. F. J. Van Antwerpen, 25 West 45th Street, New York 36, N. Y.

Mar. 3-8—College Station, Texas (*Texas A. & M. College*)
TEXAS WATER & SEWAGE WORKS ANNUAL SHORT SCHOOL, Secy., V. M. Ehlers, 2202 Indian Trail, Austin 3, Tex.

Mar. 5-9—Washington, D. C. (*Shoreham Hotel*)
AMERICAN CONCRETE PIPE ASSN., 49th Annual Convention; Howard F. Peckworth, Managing Director, American Concrete Pipe Assn., 228 N. LaSalle St., Chicago 1, Ill.

Mar. 11—Chicago, Ill. (*Engineers' Club*)
CHICAGO INDUSTRAIL WATER, WASTE & SEWAGE GROUP, 314 S. Federal Street, Chicago, Ill.

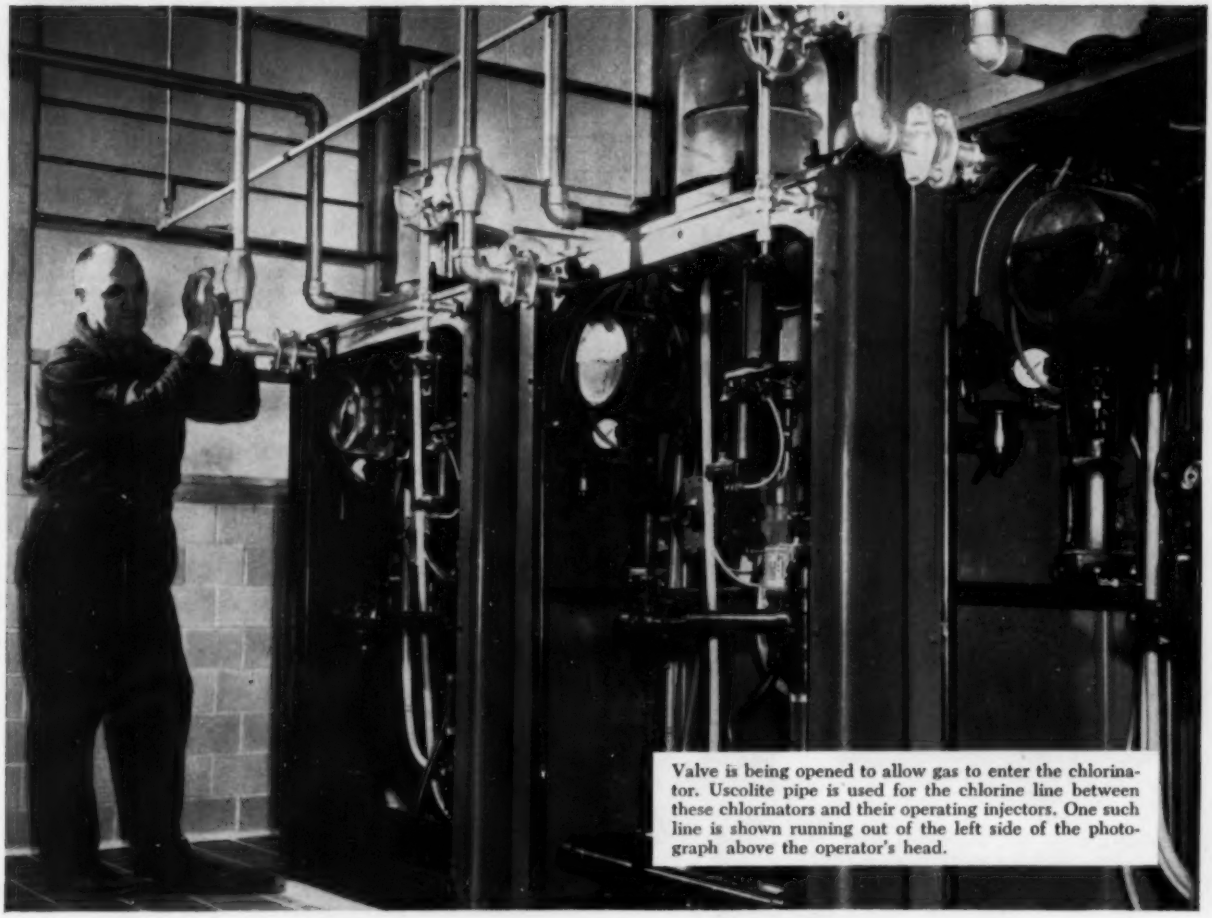
Mar. 13-15—Atlantic City, N. J. (*Traymore Hotel*)
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Michael S. Kachorsky, P.O. Box 68, Manville, N. J.

Mar. 17-20—Charleston, S. C. (*Francis-Marion Hotel*)
SOUTHEASTERN SECTION, A.W.W.A., Secy. N. M. deJarnette, Div of Water Pollution Cont., State Dept. of Pub. Health, 245 State Office Bldg., Atlanta 3, Ga.

Mar. 18-20—Little Rock, Ark. (*Marion Hotel*)
ARKANSAS WATER & SEWAGE CONFERENCE, Secy., C. W. Oxford, University of Arkansas, Fayetteville, Ark.

(*Continued on page 88A*)

USCOLITE PIPE



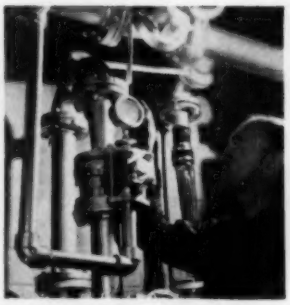
Valve is being opened to allow gas to enter the chlorinator. Uscolite pipe is used for the chlorine line between these chlorinators and their operating injectors. One such line is shown running out of the left side of the photograph above the operator's head.

For flexibility, corrosion-resistance and durability in handling chlorine

this sewage plant relies on chlorinators equipped with Uscolite Pipe

"That's because the highly corrosive chlorine does no damage to Uscolite", says an engineer with Wallace & Tiernan Inc., makers of the chlorinators used in the Westchester County Sewage Disposal Plant, New Rochelle, N. Y. Wallace & Tiernan say they find Uscolite Pipe excellent as a carrier of moist chlorine gas and chlorine solutions. They are constantly extending its use for chlorine solution lines at their installations.

Uscolite® plastic pipe is extremely light in weight, yet has very high impact strength. It will resist acids, salts, alkalies and gases, inside and out. Uscolite has the seal of approval of the National Sanitation Foundation. Completely new or replacement piping—plus a wide variety of pipe fittings, valves and sheet, slab and rod stock—all are obtainable at any of the 28 "U.S." District Sales Offices, at selected distributors or by writing us at Rockefeller Center, New York 20, N. Y. In Canada, contact Dominion Rubber Co., Ltd.



(At right) Reading dial on an operating injector. Pipe leading to left and up is Uscolite.

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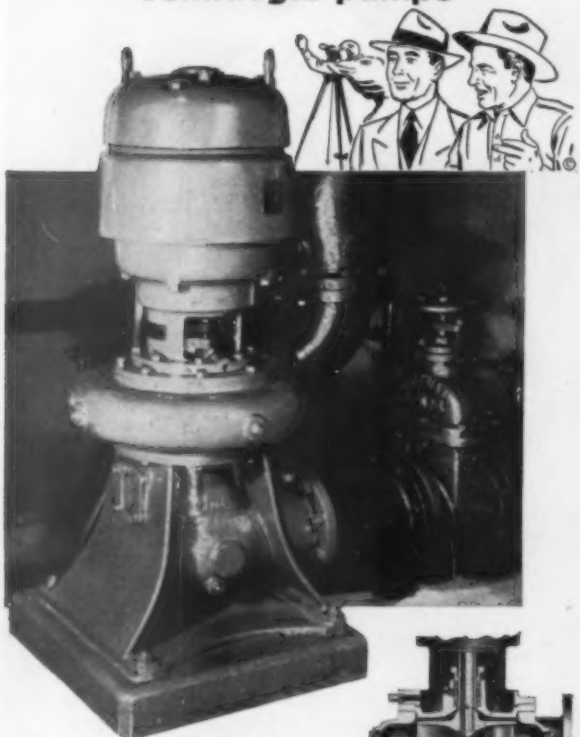

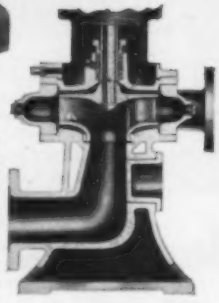

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VIRGINIA INDUSTRIAL WASTES & SEWAGE WORKS ASSN., Annual Meeting, Pres., James J. Corbalis, Jr., 835 South Payne Street, Alexandria, Va.

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SIXTH SOUTHERN MUNICIPAL & INDUSTRIAL WASTE CONFERENCE, Chairman, Dr. Nelson L. Nemerow, N. C. State College, Raleigh, N. C.

Apr. 2-4—Norman, Okla. (*University of Oklahoma*)
CORROSION CONTROL SHORT COURSE, R. V. James, Chairman, University of Oklahoma, Norman, Okla.

Apr. 4—Great Falls, Montana (*Rainbow Hotel*)
MONTANA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Harvey W. Taylor, Morrison & Maierle, Inc., Helena, Montana.

Apr. 4-5—Pullman, Wash. (*State College*)
8th ANNUAL PACIFIC NORTHWEST INDUSTRIAL WASTE CONFERENCE, Techincal Extension Services, State College of Washington, Pullman, Wash.

Apr. 4-6—Mesa, Arizona (*Maricopa Inn*)
ARIZONA SECTION, A.W.W.A. AND ARIZONA SEWAGE & WATER WORKS ASSN., Joint Meeting, Secy., H. C. Biggle-stone, Board of Fire, Underwriters of Pacific, 1106 Luhrs Tower, Phoenix, Ariz.

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MONTANA SECTION, A.W.W.A., Secy., Arthur W. Clarkson, State Board of Health, Helena, Montana

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MAINE WATER UTILITIES ASSN., Secy., Gerald F. Laurin, 89 Western Ave., Augusta, Maine

Apr. 24-26—Lincoln, Neb. (*Cornhusker Hotel*)
NEBRASKA SECTION, A.W.W.A., Secy., John E. Olsson, 408 Sharp Bldg. Lincoln, Neb

Apr. 24-26—New York City, N. Y. (*Manhattan College*)
SANITARY ENGINEERING CONFERENCE, Director, W. W. Eckenfelder, Jr., Civil Engineering Dept., Manhattan College, New York 71, N. Y.

Apr. 25—Pittsburgh, Pa. (*Mellon Inst. of Industrial Research*)
5th ANNUAL CLEAN STREAMS CONFERENCE, Secy., R. V. Wall, Penna. State Chamber of Commerce, State Chamber Bldg. Harrisburg, Pa.

May 1-4—SanDiego, Calif. (*El Cortez Hotel*)
CALIFORNIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., R. J. Barletta, 719 South Loara St., Anaheim, Calif.

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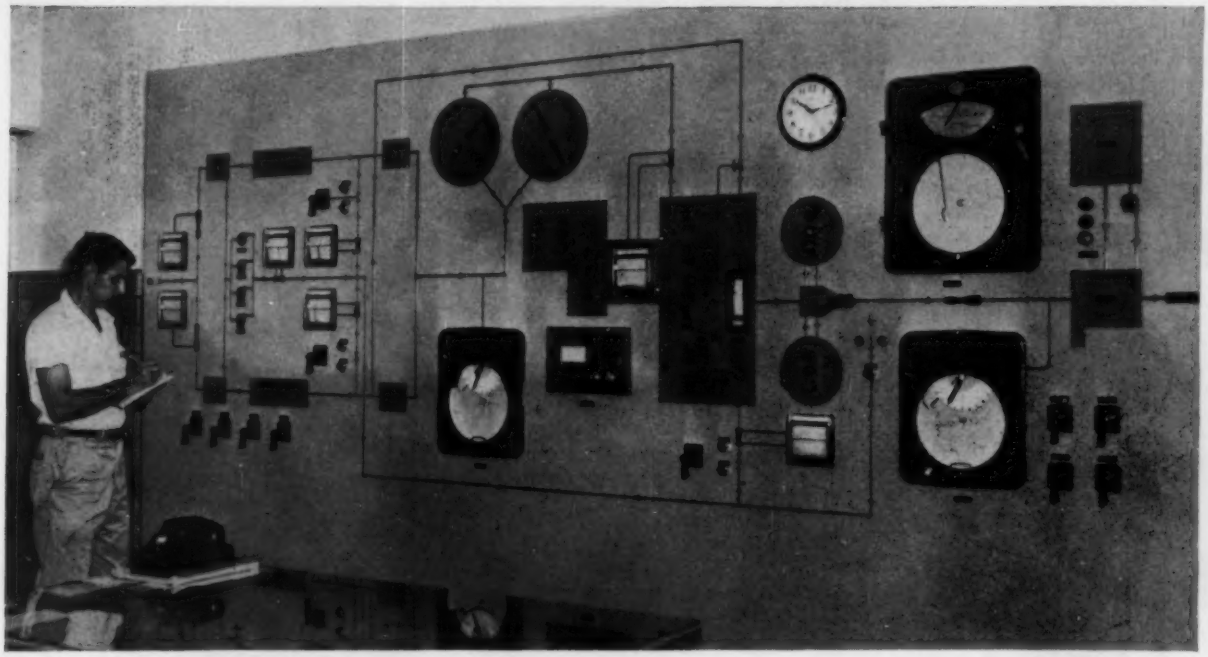

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In addition to providing the highly accurate and efficient centralized control that this modern plant requires, plant officials cite the additional help the Foxboro Graphic Panel affords in training personnel and explaining operations to visitors. It's a typical example of the many waste treatment problems successfully solved by Foxboro Instrumentation. Get similar efficiency and economy in your operation. **Write The Foxboro Company, 892 Neponset Ave., Foxboro, Mass.**

High B.O.D. of influent necessitates dual treatment at the Northside Waste Treatment Plant, Durham, N. C. — first with recirculating high-rate trickling filters, then with activated sludge. The Foxboro Graphic Panel (above) keeps all vital operating data constantly before one operator. Foxboro Instruments on panel measure: pH of influent and of trickling filter effluent; flow to filters; plant effluent flow; and return and waste sludge flow. *Consulting Engineers: Piatt and Davis, Durham, N. C.*

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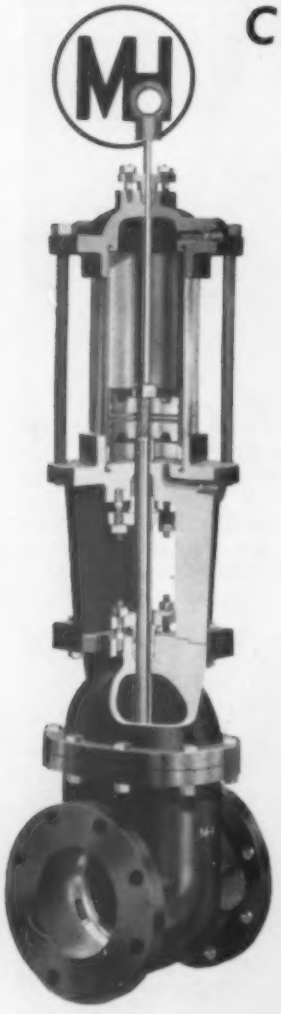

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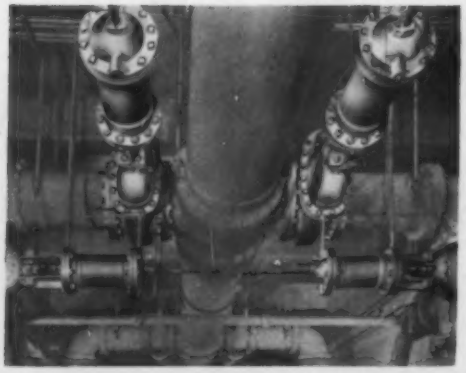

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N. J. Section Openly Goes on Record Against Fluoridation

The following resolution against the addition of fluorides to public water supply was adopted by the Board of Trustees of the N. J. Section of the Am. Water Works Association and its new secretary, A. F. Pleibel of Maplewood N. J., was instructed to publicize such resolution, which reads as follows:

WHEREAS, it has been amply demonstrated that any benefits from the application or ingestion of fluorides can be obtained by various other effective means;

and

WHEREAS, the addition of fluorides in no way improves the quality and safety of the water supply to which it is added;

and

WHEREAS, it has not yet been satisfactorily determined as to who would be responsible for real or alleged damage or losses to persons, material, or industrial processes, due to the addition of fluorides;

and

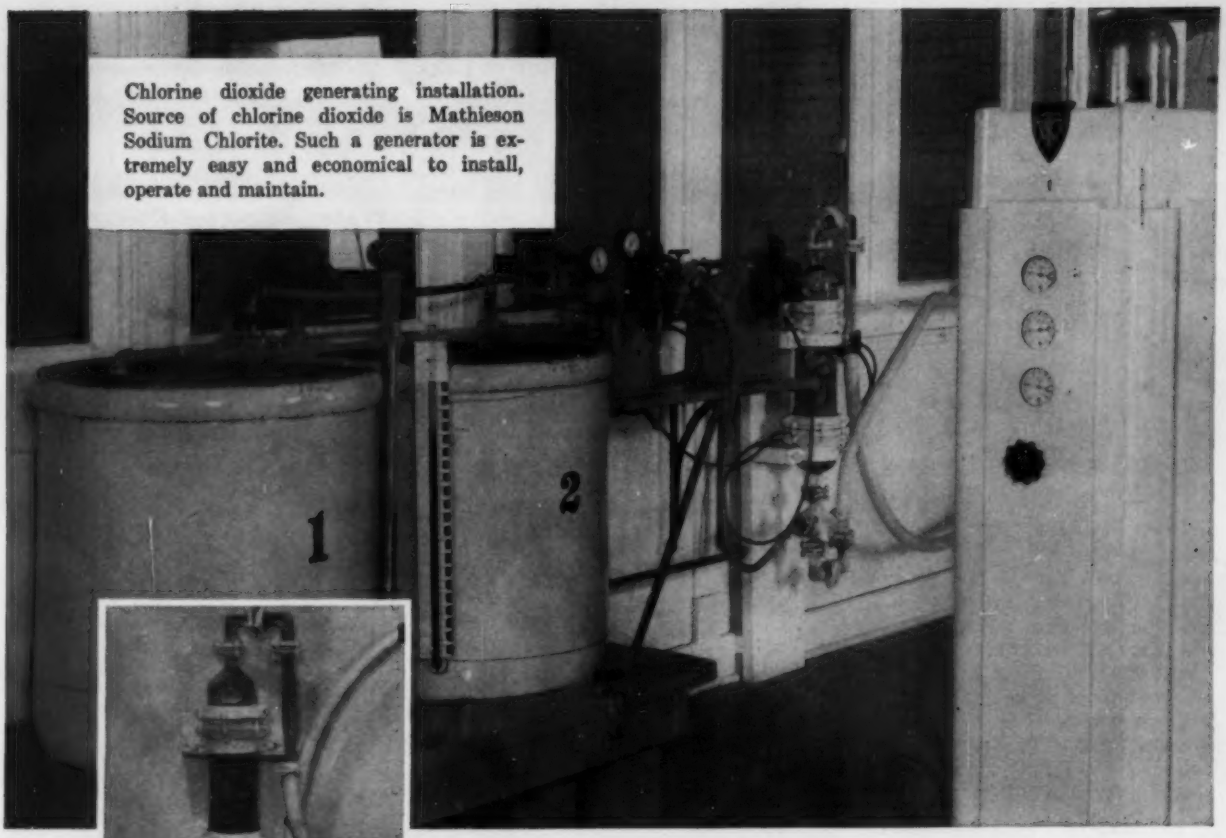
WHEREAS, the addition of fluorides to a public water supply, without the approval of a majority of the citizens, is forced mass medication;

and

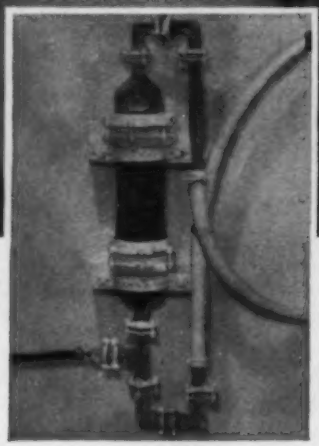
NOW, THEREFORE, BE IT RESOLVED that the New Jersey Section of the American Water Works Association disapproves of the addition of fluorides to any public water supply;

and

BE IT FURTHER RESOLVED, that no fluorides be added to any public water supply until a majority of the qualified voters approve the addition of fluorides to their water supply.



Chlorine dioxide generating installation. Source of chlorine dioxide is Mathieson Sodium Chlorite. Such a generator is extremely easy and economical to install, operate and maintain.



eliminate
unpleasant tastes and odors effectively, economically
with CHLORINE DIOXIDE

Want to insure water that's free from odors and unpleasant tastes? Then use chlorine dioxide to counteract phenols, algae and industrial wastes in your raw water supplies.

Chlorine dioxide effectively oxidizes phenols to inoffensive residues . . . destroys algae and undesirable bacteria.

This method—using safe, easy-to-use sodium chlorite to produce chlorine dioxide—provides a convenient, effective, economical means of purifying water supplies. It removes iron and manganese. In many cases it eliminates the need for carbon and ammonia in water treatment. And, unlike breakpoint or superchlorination, this method requires little control or supervision.

Get full technical information about water purification with chlorine dioxide produced from Mathieson Sodium Chlorite. Mail the coupon today.

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Industrial Chemicals Division
Baltimore 3, Maryland

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3862

C. A. Haskins is Dead

Charles A. Haskins, senior member of the engineering firm, Haskins, Riddle and Sharp of Kansas City, Mo., died on December 28th. He was 69 years old.

Born in Galva, Kansas, Mr. Haskins attended the Univ. of Kansas and won his B.S. degree in 1910. He took graduate work at Harvard Univ. and obtained the M.S. degree in 1914. He then joined the Kansas State Dept. of Health, became its chief sanitary engineer and also professor of sanitary engineering at the Univ. of Kansas. During this time he obtained the degree of Civil Engineer from the University.

In World War I Mr. Haskins served in the Army Sanitary Corps with the rank of captain. He then joined the Kansas City firm of Black & Veatch, engineers. In 1922 he established his own office in Kansas City. In 1953 he formed the partnership of Haskins, Riddle & Sharp with Wm. G. Riddle and P. Clifford Sharp as partners.

Mr. Haskins was one of the pioneering sanitary engineers in the midwest. He designed many water and sewage treatment plants and was the author of a number of papers. He was active in technical societies and received the Arthur S. Bedell Award of the Federation of Sewage and Industrial Wastes Assns. in 1954 for noteworthy services in the sewage works field.

Mr. Haskins was a member of every professional society and association of consequence serving the water, sewage and sanitary engineering field. He was a member of the honorary engineering fraternities Phi Kappa Psi, Sigma Xi, and Sigma Tau. He was a Rotarian, a past president of the Engineers Club of Kansas City and the Kansas City Chapter of the Am. Soc. of Civil Engineers; an Episcopalian and member of the Masonic Shrine; a member of the Military Order of World Wars, the Kansas City Club and Mission Hills Country Club.

Named in his honor at the University of Kansas is the Charles A. Haskins Engineering Scholarship.

Oklahoma Univ. Establishes Water Resources Research

A new agency has been established at the University of Oklahoma to coordinate all research dealing with water resources and usages in a state that continually must face drought conditions.

Director of the Bureau of Water Resources Research will be George W. Reid, CE, Associate Professor of Civil Engineering and Co-ordinator of Sanitary Science. Reid has had wide experience in this field. Dean L. H. Snyder of the University of Oklahoma Graduate College will serve as chairman of the Policy Board which will outline general procedure for the bureau.

Oklahoma has become acutely water conscious and Reid's bureau will coordinate investigations and studies of water resources and undertake research and development concerned with specific and general problems relating to water supplies and consumption.

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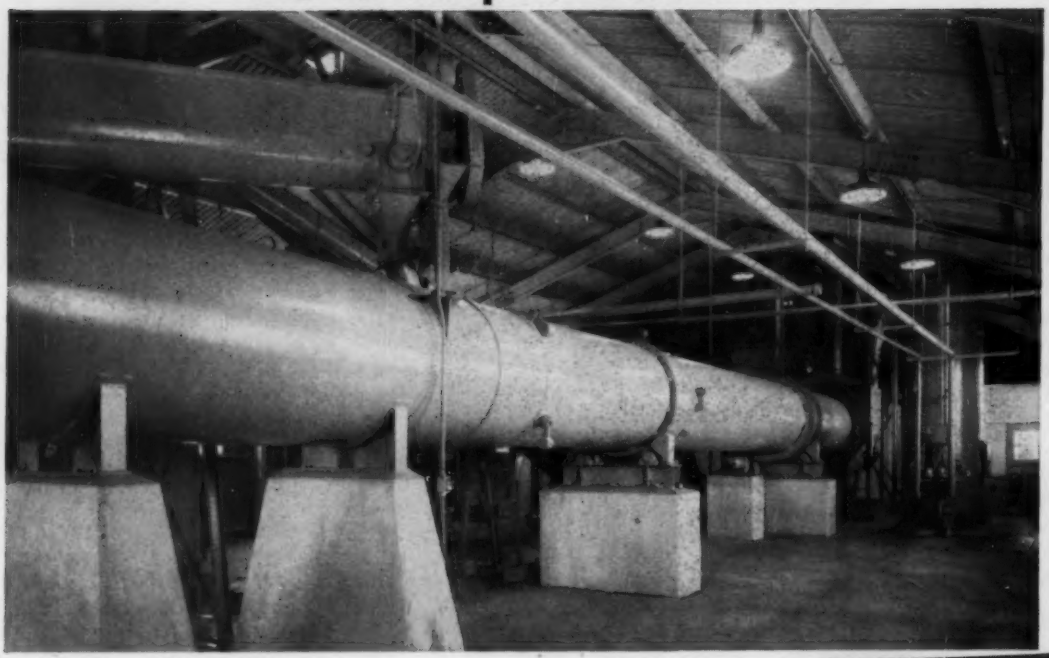
STANDARD HERSEY DRYERS...

solve Sludge Disposal problem

FOR Corpus Christi



STANDARD STEEL'S PUSH BUTTON PLANT SAVES SPACE, PRODUCES A MORE SALEABLE PRODUCT AND OPERATES MORE EFFICIENTLY AT HALF THE ORIGINAL COST OF OLDER CONVENTIONAL DRYERS. The equipment is compact... the original investment is lower by nearly one-half than for older style dryers... the operation can come on-stream quickly and easily and can be shutdown just as smoothly...these are a few reasons why more and more cities and municipalities are taking a close look at STANDARD-HERSEY Rotary Dryers.

The installation at Corpus Christi, Texas is a good example of the efficient all-weather, economical operation possible using Standard Rotary Dryers for handling sludge. Each of the two dryers installed there has a normal capacity of more than 1 ton of sludge per hour. Abrasion in duct work is much less with rotary dryers because of the lower speed of travel of sludge and because the sludge is not smashed into a powder and forced into a swift air stream. A saleable product of uniform particle size and non-dusting quality is the result of the gentler treatment in rotary dryers.

Investigate the many other advantages of this system for handling sludge and industrial wastes... write for more details.

PUSH BUTTON OPERATION!

Every Standard-Hersey installation is under the complete control of a central control board. The operation is simple to understand—to operate.

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STANDARD HERSEY DRYERS

PILOT TESTING

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

W&SW

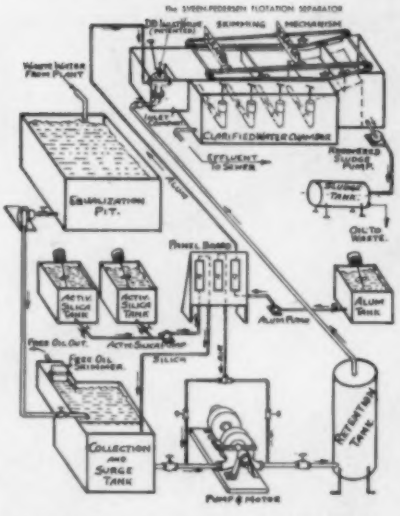
New Equipment

Flotation Treatment of Oily Waste Waters

201

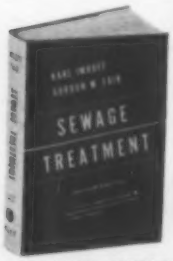
Sveen-Pedersen Sales Corp., Long Island City, N. Y., has just installed its latest Patented DD Valve Flotation Separator for the treatment of oil bearing waste waters containing soluble oils and related petroleum products from machining operation, processing washers, and waste drains.

The oily waste water is collected and blended in a large equalization pit. From there it is sent to a smaller collection tank where the free oil is automatically skimmed off. The waste water is then injected with atmospheric air and activated silica at the main feed pump suction and pumped through the air-dissolving retention tank under sufficient pressure to completely



dissolve the entrained air. The mixture then flows through the double disc release valve located in the inlet compartment of the flotation unit. Simultaneously, into the double disc valve vacuum zone, aluminum sulfate solution is introduced via a specially designed feed ring, creating the necessary floc. The tiny air bubbles produced by the valve attach themselves electrostatically to the coagulated waste particles producing a buoyant floc which insures rapid flotation. The floated material is skimmed from the surface of the separator by means of scraper flights, while the clarified water is withdrawn at the bottom of the unit through specially designed draw-off tubes to the sewer.

The separator will handle up to 125 gallons per minute of oily waste water which may contain up to 5000 parts per million of suspended solids.



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Tests anything that can be oven-dried... just load... set time and heat... and let the instrument do the rest.

ALL the operator has to do is load the pan and set the timer and heat control to get quick, accurate, permanently recorded moisture readings of granular solids, pastes, liquids, waxes or anything else that can be dried by heat.

The portable IR Moisture-Matic, a product of Moore-Milford Corporation, utilizes *far* infrared for highest absorption and rapid, even heating, and has both a self-contained timer and variable heat control between 30 and 600 watts. The motor driven torsion balance automatically weighs the sample after the test, and the moisture percent is retained on a 3 digit counter to the nearest 0.1 percent. Operates on 115-volts, 60 cycles AC.

All components are of instrument quality to assure long life without maintenance expense. For guaranteed accuracy and speed in your moisture testing, ask your Scientific Products representative for a demonstration or write us today.

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Portable Vacuum Tube Millivoltmeter

202

Fisher Research Laboratory, Inc., Palo Alto, Calif., has developed a battery operated vacuum tube millivoltmeter for making direct, accurate, in-the-field measurements of very small potentials.

Mounted in a leather carrying case this millivoltmeter is specifically designed for field measurements of small potentials associated with corrosion problems and other tests. Essentially infinite input resistance, 19 megohms, on all ranges provides minimum disturbance to the circuit under test. Six full scale ranges between 0-25 and 0-1000 millivolts and two additional ranges, 1-10 and 0-100 volts, are provided. The new instrument is available in both DC and AC models.

New Facing Protects Plug Valve Cores

203

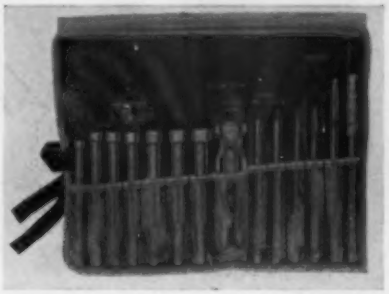
DeZurik Corporation, Sartell, Minn., has designed a new and efficient plug valve with a plug facing of Hycar American rubber.

Bonded to the metal plug-core, the Hycar facing has the rigidity to close tightly, yet retains the surface resiliency to seal around solids which may lodge on the valve seat. This resiliency also resists abrasion from solids in the flow, eliminating scoring on the plug face. Hycar also has high resistance to chemical attack.

Tool Kits for Laboratories

204

Burrell Corporation, Pittsburgh, Pa., has announced availability of two new tool kits for laboratory technicians. The kits have been added to the Burrell line to meet the demand for an all-purpose set of



tools in one handy carrying case at a low cost.

All blades and handles are interchangeable. The smaller of the two kits includes an Amberyl handle and six screw drivers in a seven section plastic tool roll. The larger, all-purpose kit includes a heavy-duty handle, five screw drivers, seven hex wrenches and one 5" extension in a fourteen section plastic tool roll.

BEFORE and AFTER SALE "FLEXIBLE" is at your service!

Only "Flexible" has a nationwide group of Sales Engineers devoting their full time, in the field, to sewer-cleaning problems. Their years of practical experience assure you of sound advice in choosing equipment for your needs.

Sales Engineer McDermott, having recommended Flexible Bucket Machines to Gloucester, Mass., is seen here proving what they will do. After observing the results obtained in 1 hr. 15 min., the City Officials were "sold."

But, "Flexible" service does not end with the sale. Your men are instructed in the correct use of these machines, and periodic calls are made to assure performance comparable to the demonstration.

If this makes sense to you—"to buy only from the one firm offering these advantages"—arrange to see your nearby "Flexible" Sales Engineer soon.

FLEXIBLE INC.

3786 Durango Ave., Los Angeles 34, Calif.

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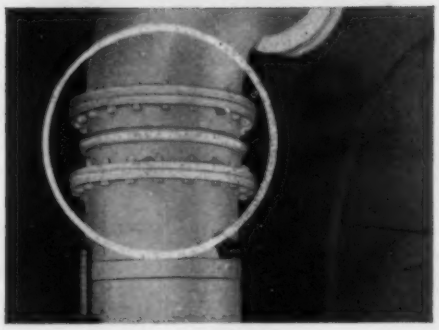
How long can a U. S. Rubber Expansion Joint last



...some have been on the job since 1926, the year they were invented!

Here are just a few reasons why *these flexible connections are used in pressure or vacuum pipe lines...*

- U. S. Rubber Expansion Joints are resilient and, therefore, do not, like metal, set permanently when compressed.
- Constant flexing merely keeps "U. S." joints "alive"... prevents them from becoming brittle.
- They absorb both axial *and* lateral deflection far more than metal joints. Greater insulation against vibration and pump noises is provided.
- There is never any electrolysis, corrosion or erosion.
- U. S. Rubber joints handle pressures from 40 lbs. to 125 lbs. Compare!
- The outside diameter of the arch is smaller than that on metal joints. Face-to-face dimensions (even with multiple arches) are smaller.
- Weight is much less. This, plus the fact that no gasket is needed between flanges (unlike metal joints) results in an easier installation, lowering the cost.

"U. S." was the first to develop rubber expansion joints. They are at work in every kind of industry, prolonging the life of equipment in pressure or vacuum pipe systems. Obtainable at any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

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Electric Rotary Hammer Drills 40% Faster

205

Demo-Haines Tool Corp., Enid, Oklahoma, has developed a new portable electric rotary hammer which uses shock waves to drill holes 40 per cent faster.

Creating over 36,000 shock waves a minute, it cuts a clean, true hole up to 40 feet in depth through the hardest stone, rock or even reinforced concrete. Weighing 10 pounds, the hammer requires no pressure and difficult overhead or horizontal work is handled with ease. Designed for drilling $\frac{3}{16}$ inches up to 1½ inches diameter in concrete or masonry, the unit is powered by a rugged Thor-built electric motor which operates on regular 115 volt AC or DC current at 1000 rpms. Hammer measures 16 inches and delivers 6000 BPM.

Twin Flow Transmitters

206

Brooks Rotameter Co., Lansdale, Pa., has developed new pneumatic and electric transmitters for use with Brooks Rotameters, utilizing advanced design features that represent a new approach to standardization and in-the-line performance.

The Mag/Nu/Matic Pneumatic Transmitter employs direct force balance to absolutely minimize mechanical motion. This provides low inertia characteristics and improved response time. Only three simple screw driver adjustments take care of range, linearity and zeroing.

The Elec/Tru/Matic Electric Transmitter utilizes the proven strain gage element. The standard model is explosion proof. It can be used practically with any receiving instrument and is applicable to automatic logging and data reduction equipment.

Portable pH Recorder

207

The Bristol Co., Waterbury, Conn., has developed a portable, self-contained, pH measuring and recording instrument requiring no external power supply.

The new device consists of two units: a Bristol model 524 pH recorder and a Beckman N-2 amplifier. This equipment will cover the total pH range of 0-14 in two partial ranges of 0-8 and 6-14. Selection is by means of a switch located on the amplifier. The recorder uses carbon-coated 8-inch diameter charts, and makes a record with a vibrating-type stylus. The chart drive can be set to rotate the chart in either 1 hour or 24 hours, depending on the application. Temperature compensation is by means of a manual adjustment, after reading the temperature of the liquid being tested. Various types of electrodes are available, including those for immersion, flow, and laboratory.

Coupler For Portable Pipe Lines

208

John Bean Division, Food Machinery & Chemical Corp., San Jose, Calif., has developed an industrial coupler for portable aluminum pipelines that will withstand working pressures up to 1,000 PSI.

Called the FMC Fast Move Coupler, it is a fast acting coupler with heavy breach-acting jaws that secure it with a quarter turn. A lock screw spins up in an instant and locks the coupler against untwisting through line torque. No metal

R. D. Wood, Leader Since

A Low-Cost Hydrant You Can Depend On

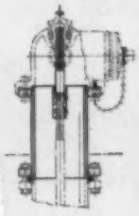
The R. D. Wood Standard Swivel Joint Hydrant gives you the most for your money in strength, reliability and sound design. The *all-bronze stuffing box*, gland and operating nut prevent rust and corrosion. Internal friction which might lower pressure is reduced to well below A.W.W.A. specifications by tapered nozzleways and carefully rounded changes in diameter.

Breakable Flange and Stem Coupling

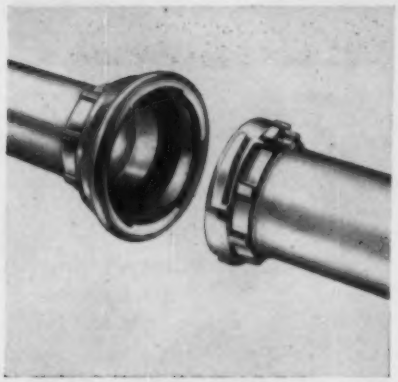
Available at slight extra cost. Designed to snap under a blow which would otherwise smash the hydrant, flange and stem coupling can be inexpensively and quickly replaced without excavation.

Extension Piece

Can be inserted without interrupting water flow.



Hydrants now available with O-Ring Seal when specified



part of the coupler is exposed to the material within the line; a special aromatic resistant Buna-N gasket is placed so that there is almost no disturbance of flow to create friction losses. The gasket is pressure sealing.

Electronic Potentiometer Records On 3-Inch Strip-Chart

209

The Bristol Co., Waterbury, Conn., has developed a new self-balancing electronic potentiometer which gives a continuous record on a 3-inch strip-chart.

The new Dynamaster recorder, which uses standard components, is housed in a case only 5 inches square. Offered in either potentiometer or a-c bridge models, the new instruments can be used to measure and indicate or record any variable which can be converted into an electrical quantity, such as temperature, pressure, flow, speed, pH, smoke density, resistance, etc.

Valve Box Locator

210

Aqua Survey & Instrument Co., Cincinnati, Ohio, has available a valve box locator that assures non-variability of performance anywhere in North America.

This new inexpensive locator employs a new "electric braking" action to reduce needle spinning to an absolute minimum. Other features are: instant topview reading assured by mirror construction; guaranteed to function in location regardless of ground cover; chrome nickel handle helps define difficult locations; has a convenient shoulder strap, no stooping to read; and can be used as a sensitive, accurate compass.

Inclined Gages For High Or Low Mounting

211

Jerguson Gage & Valve Co., Somerville, Mass., has available inclined Truscale remote reading liquid level gages for use where the gages have to be mounted high or low on the instrument panel, or at other points.

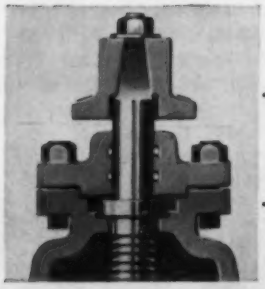
Truscale gages have a convex face, with scale marking directly on the face, giving 180° visibility.

(*Continued on page* 100A)

1803, Presents

A Gate Valve Built for Generations of Trouble-Free Operation

The R. D. Wood Gate Valve can be depended on to work and keep on working for years. It is simply constructed—a spreader and two discs are the only moving parts. The discs are free to revolve their full circumference, preventing uneven wear on faces and seats. When fully open, gates are entirely clear of flow.



R. D. Wood Gate Valves now available with O-Ring Seal when specified

all available with mechanical joint and flange-type pipe connections

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superior coagulation in cold water months with

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● Brilliantly clear water, and longer filter runs are results you can count on when you use activated silica made by an N-Sol Process.* As a coagulant aid N-Sol produces tough, compact floc and a much faster settling floc.

Write for instructions and samples for jar tests.

N-Sol is prepared in your plant with N sodium silicate and a reacting chemical. No charge for license under our N-Sol Process Patents.

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PQ SOLUBLE SILICATES

Truscales can be read from any point from which the face can be seen, and inclined Truscale gages make possible a very high or very low installation that still gives maximum visibility.

Package Sewage Pumping Stations

212

The New England Pump and Machinery Co., Quincy, Mass., has introduced a series of fully automatic sewage pumping stations incorporating pneumatic ejectors as the pumping media.

The stations are available in capacities from 10 to 70 gpm against various discharge heads. Features of these stations are: completely watertight construction; alternate electrical system to permit automatic operation in case of power failure; and they are available at a low initial cost. Design of this series of stations is directed at residential areas where the completely hidden station is not detrimental to property in the general area.

Portable Direct-Reading Dissolved Oxygen Analyzer

213

The Dorber Company, Chicago, Ill., has developed a portable dissolved oxygen analyzer which operates as simply as a modern pH meter.

The instrument, an amperometric type, employs a rotating platinum electrode with a unique, stable electronic system which automatically translates diffusion current into units of dissolved oxygen concentration. It determines dissolved oxygen from 0 to 10 ppm within 5% of the true value for most aqueous solutions. The instrument can also be operated in the laboratory with 115 V A.C. and is not

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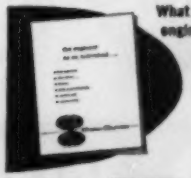
If this specification fits you . . . and most important, if you like the concept of the sales engineer as a creative individual, we would like to hear from you. A letter, collect call or wire to E. E. Johnson, our Director of Personnel at Stamford, Connecticut, is all that's needed. We'll do our best to arrange an interview at your convenience.



What do we mean by "creative" engineering? We'd like to send you a copy of "The Engineer as an Individual" . . . a new booklet which describes briefly our concept of the importance of the engineer to our worldwide operations

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affected by power line voltage fluctuations.

An important feature is that, unlike the conventional Winkler test

for dissolved oxygen, this new instrument is not subject to interference by dissolved iron, calcium, magnesium, sulfides, nitrites, or organic matter. Samples can be colored or turbid.

Plastic Waterstops

Electrovert Inc., New York, N.Y., has available waterstops made of Bakelite vinyl resins.

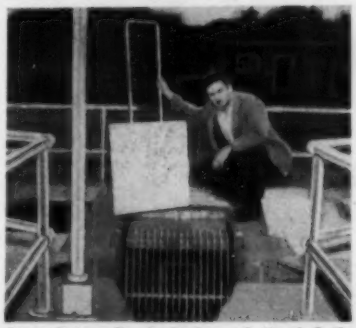
According to the manufacturer, these diaphragm-type waterstops for expansion and construction joints are expected to outlast the structures in which they are used. Because the waterstops have excellent elongation they can stretch or contract to keep the joints watertight as the joints open and close in winter and summer. Bakelite resins were chosen not only for their elasticity and strength but for their resistance to water and the acids and alkalies in concrete as well. Ridges are formed on both sides of the diaphragm-like ribbon to give the waterstop a better grip on the concrete.

Fifty-foot coils of the waterstop are easy to handle and can be shipped at low cost. Splicing is a simple matter of heating the ends to be joined and holding them together until they form a bond.

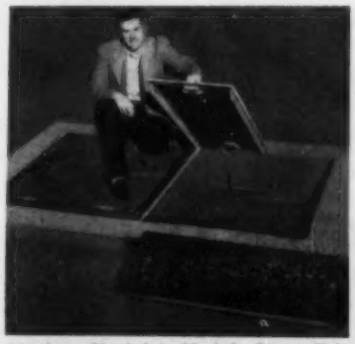
Above: Settling basins and drying beds of the modern new Sewage Treatment Plant at Clinton, Mass., showing maintenance-free aluminum railings and walkways constructed by WACO.

WACO Fabricated Aluminum Equipment Serves Mass. Sewage Treatment Plant

George H. Hill, WACO's New England Representative, points out patented perforation pattern in WACO fabricated walkway.



Stop Gates, Trash Racks and Hand Railings of non-corrosive aluminum, specially fabricated by WACO for trouble-free service.



Aluminum Checkplate Manhole Cover. Note the Aluminum Ladder.

The Clinton, Mass., Sewage Treatment Plant is typical of an aluminum installation fabricated by WACO, for use where long-range durability, sanitation and maintenance-free service are desired. The aluminum walkways, gratings, handrailings, manhole covers, ladder rungs, stop gates, trash racks and stairways of the Clinton Plant illustrate WACO's precision fabrication and quality control to meet the most exact specifications.

Today, an increasing number of water and sewage installations are benefitting through WACO's experience and specialization in aluminum fabrication—including exclusive Heli-Arc and Sigma welding techniques.

WACO's experienced engineers and custom-fabrication facilities are at your disposal in designing and fabricating aluminum equipment to your exact requirements.

METCALF AND EDDY
Architects and Engineers

R. ZOPPO CONSTRUCTION CO.
Prime Contractor

GROISSER AND SHLAGER IRON WORKS
Sub-Contractors

For prices, data sheets, etc. and the representative in your area, write

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Dept. 13-B BALTIMORE 29, MARYLAND
PHONE: Arbutus 2700

"One Man" Field Tool Machines any A-C Profile

Cuts lathe-smooth joints with machine shop precision *faster, and right on the job,* for:

- RING-TITE COUPLINGS
- SIMPLEX COUPLINGS
- ROTO-SPLIT FLANGES
- POURED FLANGE ASSEMBLY
- TAPERED COUPLINGS
- MAKING CLOSURES
- END FACING

Save on installation time, salvage broken and short pieces, eliminate machine shop, lathe, and hauling costs! This one-man tool accurately machines closures up to 9" couplings, on the job! Approved by leading A-C pipe manufacturers. Ask for it, and Spring Load A-C Pipe Cutters at your suppliers, or write.

model B
SPRING LOAD A-C MACHINING AND TAPERING TOOL

Sizes for 4"-8" and 10"-20" pipe. For holding 4"-20" A-C pipe, use Spring Load V-20 vise.

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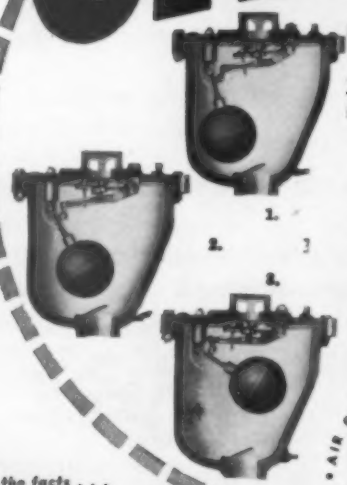
3610-E First Ave. So., Seattle 4, Wash.

Crispin

UNIVERSAL AIR VALVES

Cut installation costs . . . provide complete air control



New Crispin 2" Universal Air Valves give positive, full-time, air control: (1) permit escape and entrance of air when line is being filled or emptied; (2) allow escape of accumulating air while line is in operation . . . and under pressure and (3) valve in closed position after air is exhausted. Cut-a-way illustrations show the operating positions. Simplified design, sturdy construction . . . preferred by water works engineers.

AIR CONTROL VALVES FOR OVER 40 YEARS

multiplex
MANUFACTURING COMPANY
BERWICK, PENNSYLVANIA

Get the facts . . .
Write today for complete information on new Crispin Universal Air Valves and for your copy of the Crispin Air Valve Catalog.

W & SW Manufacturers' News

National Pool Opens Modern Plant

National Pool Equipment Company, Florence, Alabama, has opened their new modern manufacturing plant and general offices in Florence.

The new plant will manufacture under one roof a complete line of quality swimming pool equipment. The plant consists of 67,000 square feet of floor space which accommodates a foundry, machine shop, chrome plating plant, filter tank fabrication plant, filter tank assembly plant, production plant, warehouse and shipping. The new office and administration building will be 400' long, 50' wide with a 100 x 100 foot ultra-modern lobby, featuring a swimming pool and a receptionist in a bathing suit.

Evans Joins Byers Co.

A. M. Byers Company, Pittsburgh, Pa., has announced that R. A. Evans has joined the Engineering Service Department.

Mr. Evans studied engineering at the University of Pittsburgh and is a graduate of Indiana State Teachers College. Prior to joining the Byers Company, the country's oldest and largest producer of wrought iron products, Mr. Evans taught mathematics in Pennsylvania and Ohio schools.

Before teaching, he was associated with Grinnell Company of Warren, Ohio, and Du Pont Chemical Research Laboratory, Tonawanda, N. Y.

CB&I Opens New Orleans Office; Promotes Harris To Manager Greenville Plant

Chicago Bridge & Iron Co., Chicago, Ill., has announced the opening of a new sales office in the Pan American Life Building, 2400 Canal Street, New Orleans, Louisiana. This office will handle sales in Louisiana and the Southern part of Mississippi.

Lucian J. Harris, formerly Philadelphia District Sales Manager, has been appointed Manager of

the Greenville Pa., Plant of the company, succeeding W. S. Nesbitt, who has retired.

Manager of the new Sales office in New Orleans is J. U. Blanchard, who since 1946 has been in the Houston, Texas, sales office. Mr. Blanchard started to work for the Company in 1937 in the Birmingham, Alabama, plant.

Dresser Appoints Three Sales Representatives

Dresser Manufacturing Division, Dresser Industries, Bradford, Pa., has announced the appointments of Jack Bradigan, Cornelius Zippro, and Fred Frey as sales representatives.

Mr. Bradigan will represent the company in sections of New York, Pennsylvania and Ohio with headquarters in Bradford. For the past several years Mr. Bradigan has been associated with the customer service branch of Dresser's sales department.

Mr. Zippro will service the Southeast area with headquarters in Atlanta, Georgia. Prior to joining Dresser he was associated with the South Jersey Gas Company and the Yarnall Waring Company.

Mr. Frey will cover the Pacific Northwest area with headquarters in Portland, Oregon. He is a native of California. Prior to his association with Dresser, Mr. Frey served in a sales capacity with the Republic Supply of California.

Allis-Chalmers Promotes Costigan

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced that J. F. Costigan has been appointed assistant director of manufacturing of Allis-Chalmers Industries Group.

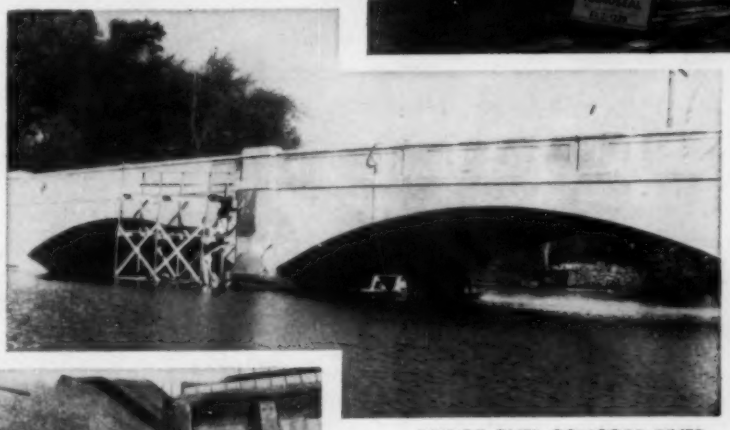
Costigan had been works manager of the company's Norwood (Ohio) Works since January, 1953.

He started his career with Allis-Chalmers in 1918 as a machinist in the West Allis shops, moving through a succession of positions in the manufacturing department there until he was named an assistant to the general works manager of the Industries Group at West Allis Works in 1945.

In 1951 he was transferred to the Norwood Works as assistant works manager, a position he held until his promotion to works manager there.

It's *New Again* with THORITE and THOROSEAL

Freeze-thaw cycle following water and moisture penetration, also swelling of reinforcing rods from moisture contact, cause masonry destruction.



BRIDGE OVER CONCORD RIVER
ROUTE 3, BELLERICA, MASS.

Workmen on scaffold patch spalled and cracked concrete with THORITE and seal surface with THOROSEAL.

Area at left chipped to sound masonry. It will then be patched with THORITE *Nonshrink, Nonslump 20-Minute Set Patching Mortar*, without necessity of costly forming, finished by application of Thoroseal.

Request Circular No. 16 and 20.

Write for our 16 page "How to Do It"

STANDARD DRY WALL PRODUCTS, INC.
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CAST IRON PIPE

Produced in one of the country's most modern plants under most exacting metallurgical, chemical and physical controls from the raw material to the finished products.

For water, gas and sewage.

Sizes 3" to 24" in modern long lengths. Bell and spigot, roll-on-joint, mechanical joint and flanged.

Inquiries invited to our nearest sales office:

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350 Fifth Avenue, New York 1, New York

ALABAMA PIPE COMPANY

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The Modern Way...

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- Stadiums
- Bridges
- Sea Walls
- Swimming Pools

Write for more information, including 48 page "Gunite" booklet.

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Liberty Life Bldg. CHARLOTTE, N. C.
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193 Emmet Street NEWARK 5, N. J.

Caudle to Head New Roots-Connersville San Francisco Sales Office

Roots-Connersville Blower Division of Dresser Industries, Inc., Connersville, Indiana, has established a San Francisco sales office in the Balboa Building, 593 Market Street, San Francisco 5, California.

According to the announcement, Arlie E. Caudle will head the new office. He is responsible for the organization and management of the sales territory assigned to the San Francisco office, which includes the counties in central and northern California and western Nevada.

Caudle has been associated with Roots-Connersville for more than ten years, serving first as Chief Application Engineer and then as Manager of Engineering. He has a B. S. degree in Mechanical Engineering from Oregon State College.

Presstite-Keystone Increases Production Facilities

The Presstite-Keystone Engineering Products Company, St. Louis, Mo., has announced the acquisition of additional manufacturing facilities for the St. Louis plant.

The new property covers approximately 4 acres in the Central Industrial Drive area.

The expansion includes a large-2-story manufacturing building, a smaller auxiliary manufacturing building, three 10,000 gallon blending tanks, three 10,000 gallon raw material storage tanks, as well as rubber mixers, powder grinders and mixers, and other necessary equipment.

Cleland Joins Dresser

Dresser Manufacturing Division, Dresser Industries, Inc., Bradford, Pa., has announced that M. C. Cleland has been appointed General Markets Sales Representative. Cleland will cover Texas, Oklahoma and Arkansas.

Before joining Dresser, he had been director of procurement for the Universal Corporation. Previously he had been associated with the Charles Wheatley Co. and the Sawyer-Jensen Manufacturing Co. Cleland attended Oklahoma School of Business, Central State College and the University of Tulsa.

Wallace & Company Appointed By Roots-Connersville

Roots-Connersville Blower Division of Dresser Industries, Inc., Connersville, Indiana has appointed G. M. Wallace & Company of Denver, Colorado as Field Application Engineers for all Roots-Connersville products. G. M. Wallace & Company headquarters are in Denver with offices in Salt Lake City, Utah and Butte, Montana.

According to the announcement, the territory assigned to them includes Colorado, Wyoming, Montana, Utah, New Mexico, eastern Nevada, southern Idaho and western Texas. G. M. Wallace & Company is headed by G. M. Wallace who, prior to forming his present company, was Assistant Sales Manager for the Bailey Meter Company.

Oliver Corp. Promotes Two

Oliver Corporation, Chicago, Illinois, has announced that Samuel W. White, Jr., and Donald Koegle have been elected vice presidents.

Mr. White will head the industrial sales division and Mr. Koegle will have charge of domestic farm machinery sales.

Edward H. Fisher, vice president, formerly manager of the industrial sales division, has been appointed head of the newly created special products division, and will have supervision of all United States and Canadian sales of the company's numerous industrial and defense products.

Peerless Pump Appoints Two Sales Engineers

Peerless Pump Division, Food Machinery and Chemical Corporation, Los Angeles, California, has announced the appointment of Max H. Richter, Jr., of New Orleans, and George Ries, of Cleveland, as sales engineers.

Richter, who attended Louisiana State University, has been assigned to handle sales of the company's engineered vertical and horizontal pump lines in Louisiana and Arkansas and Ries, who attended Cincinnati University, has a similar assignment for the state of Ohio. Both Richter and Ries have been in pump sales for the past four years.

E. R. P. engineer inspects control panel for cathodic system protecting clarifiers at Louisville Water Co., Louisville, Ky.

E. R. P. CATHODIC PROTECTION

stops corrosion at lowest overall cost

Electro Rust-Proofing Cathodic Protection is used by the Louisville Water Company to prevent corrosion of metal underwater equipment in the raw water clarifiers.

Cathodic protection is the one method able to reduce corrosion of underwater metal virtually to zero. Electro Rust-Proofing Cathodic Systems are designed to provide the sole protection of submerged structures or to supplement a good protective coating. When used in conjunction with coatings, cathodic protection eliminates corrosion due to holidays or inherent breaks in coatings such as can occur at many inaccessible structural joints.

Electro Rust-Proofing designs every cathodic system individually so that maximum protection is given for the lowest operating cost. For information about E.R.P. Cathodic Protection, write for Bulletin #E-39.

E·R·P

ELECTRO RUST-PROOFING CORP.

A SUBSIDIARY OF WALLACE & TIERNAN INC

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HOW TO DETECT 3 PARTS CHLORINE IN A MILLION PARTS AIR

New W&T Solvay Chlorine Detector*

detects as little as 3 p.p.m. chlorine in a continuous air-stream sample. Automatically sets off alarm at higher concentrations.

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WALLACE & TIERNAN

INCORPORATED

25 MAIN ST., BELLEVILLE 9, N. J.

I-55 *Manufactured under patent license from Solvay Process Div., Allied Chemical & Dye Corp.

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CAST IRON PIPE

Produced in one of the country's most modern plants under most exacting metallurgical, chemical and physical controls from the raw material to the finished products.

For water, gas and sewage.

Sizes 3" to 24" in modern long lengths. Bell and spigot, roll-on-joint, mechanical joint and flanged.

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ALABAMA PIPE COMPANY

General Sales Office

ANNISTON, ALABAMA

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The Modern Way...

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- Reservoirs
- Dams
- Filter Plants
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- Sewage Disposal Plants
- Stadiums
- Bridges
- Sea Walls
- Swimming Pools

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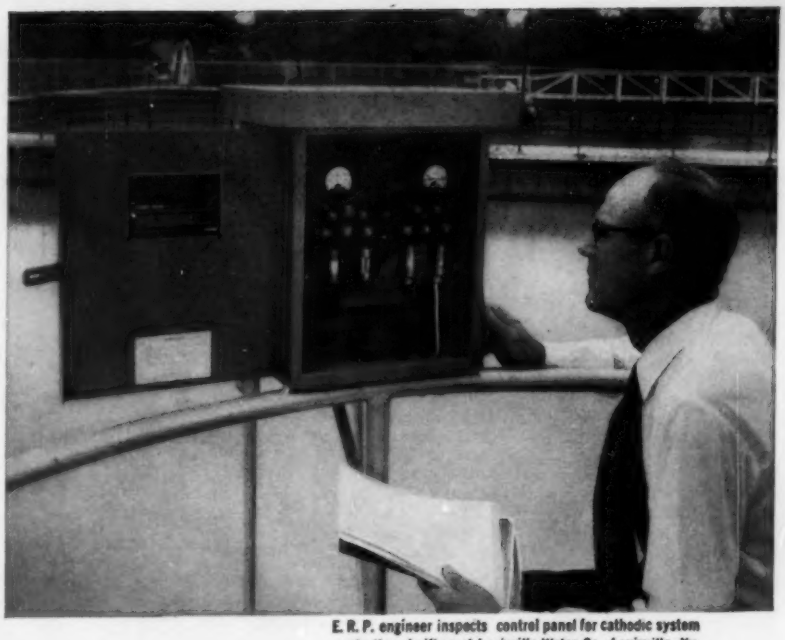

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E.R.P.

ELECTRO RUST-PROOFING CORP.

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30 MAIN STREET, BELLEVILLE 9, NEW JERSEY

HOW TO DETECT 3 PARTS CHLORINE IN A MILLION PARTS AIR

New W&T Solvay Chlorine Detector*

detects as little as 3 p.p.m. chlorine in a continuous air-stream sample. Automatically sets off alarm at higher concentrations.

Write for Publication 50.118

WALLACE & TIERNAN

INCORPORATED

25 MAIN ST., BELLEVILLE 9, N. J.

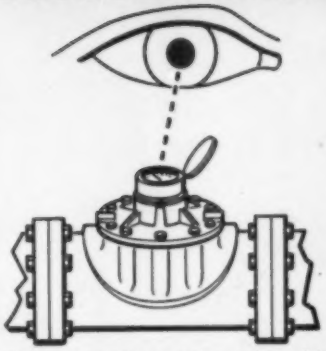
I-55 *Manufactured under patent license from Solvay Process Div., Allied Chemical & Dye Corp.

Sparling Meters

FOR INFALLIBLE MEASUREMENT OF WATER

Keep an EYE to good billing relations

Keeping your water customers happy and contented when they receive their bills is a Sparling meter obligation. The water buyer can easily and clearly read the dial, always knows how much water is delivered and accepts the meter reading conclusively. He doesn't waste water. Each meter is self-contained and continuous in operation. Each embodies the time-tested Sparling propeller, recognized as the most efficient and highest in accuracy of converting volume flow into registered measurement.



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INC.
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CINCINNATI 2, 626 Broadway
DALLAS 1, 505 No. Ervay St.
KANSAS CITY 6, MO., 6 E. Eleventh St.
LOS ANGELES 54, 945 No. Main St.
ROSELLE, N. J., 650 First Ave. West
SAN FRANCISCO 24, 85 Industrial St.
SEATTLE 99, 904A Elliott West
TORONTO, CAN., 207 Queens Quay West
ROMFORD, ENGLAND 248 London Rd.

REQUEST FOR LITERATURE,

Sparling Meter Company, Inc. WSW-2
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CITY _____ STATE _____

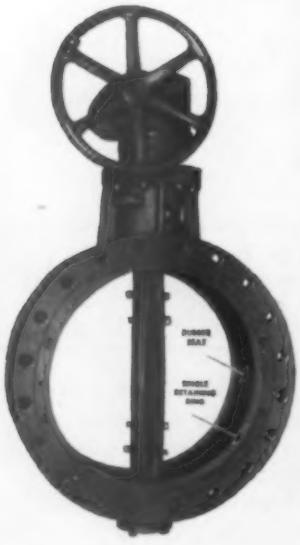
Positive drop-tight shut-off

Easy . . . Efficient . . . Economical with

LEOPOLD

Rubber Seated

BUTTERFLY VALVES



In this design, the seat is of resilient neoprene rubber or pure gum rubber, vulcanized around a steel ring insert, and held in place by a keeper ring. The steel ring, which is "continuous" to eliminate abnormal wearing, increases the firmness of the seat and assures longer service life.

Whether operated manually or by automatic controls, Leopold Butterfly Valves always provide a positive shut-off that's bubble-tight. Made in sizes 6" to 72".

Most AWWA Specifications C 504-55T

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COMPLETE WATER PURIFICATION AND FILTER PLANT EQUIPMENT • BUTTERFLY VALVES
FILTER OPERATING TABLES • MIXING EQUIPMENT • DRY CHEMICAL FEEDERS

Minneapolis-Honeywell To Build New Valve Plant

Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., has announced that a new three-acre manufacturing plant and home office for the Valve Division will be constructed at Fort Washington, Pa.

The 120,000-square-foot building, representing an investment of more than $1½ million, will house the entire manufacturing, sales, research, development, and administrative facilities of the Division.

Manufacturing facilities in the new plant will occupy some 95,000 sq. ft. of space. The research and development section will occupy approximately 10,000 sq. ft. and sales and administrative activities will occupy the remaining 15,000 sq. ft. of plant area.

To equip the new plant, some $1 million worth of plant, office and engineering laboratory equipment will be transferred to the new site.

Link-Belt Sales Organization Changes

Link-Belt Company, Chicago, Ill., has announced the following changes in its district office sales organization:

Boston—George A. Most, Jr., has been appointed district manager. For the past four years Mr. Most has been district manager of the Moline, Ill., office. He joined Link-Belt Company in 1937, serving seven years at the Philadelphia plant and eight years at the Pittsburgh district office before moving to Moline.

Moline—J. Charles Bullock has been appointed district manager, succeeding Mr. Most. Mr. Bullock has been district manager at Albany, N. Y., since 1948. He started his Link-Belt career in Indianapolis in 1935, serving at the company's two Indianapolis plants and at Atlanta before coming to Albany.

Albany—Gene A. Zwerner has been appointed district manager, succeeding Mr. Bullock. Mr. Zwerner, formerly district manager at Washington, D. C., joined Link-Belt in 1946. He served at the Chicago Pershing Road plant and at the Moline and Detroit district offices and for four years was sales manager of Link-Belt Africa, Limited.

Washington, D. C.—C. C. Wiley has been appointed district manager succeeding Mr. Zwerner. For the past six years Mr. Wiley has been district manager at Baltimore. He started with Link-Belt in 1926 at the Philadelphia plant and served in the Pittsburgh office for 17 years prior to appointment in 1946 as district manager at Birmingham, Ala.

Baltimore—Paul Waldorf has been appointed district manager, succeeding C. C. Wiley. For the past 11 years Mr. Waldorf has been a sales engineer in the Detroit office. He joined the company in 1929 and has served in Indianapolis, St. Louis, Pittsburgh, Chicago and Cleveland.

Promotions At Allis-Chalmers

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced the following promotions:

G. E. Conn, manager of the York district of Allis-Chalmers Industries Group since 1947, has been appointed manager of the Buffalo district succeeding Henry E. Weiss. Mr. Weiss has been named special representative for Buffalo.

Charles F. O'Riordan has been appointed manager of the Midwest region of Allis-Chalmers Industries Group with headquarters in St. Louis. He succeeds J. F. Burrus, recently named an assistant general manager in the Power Equipment Division.

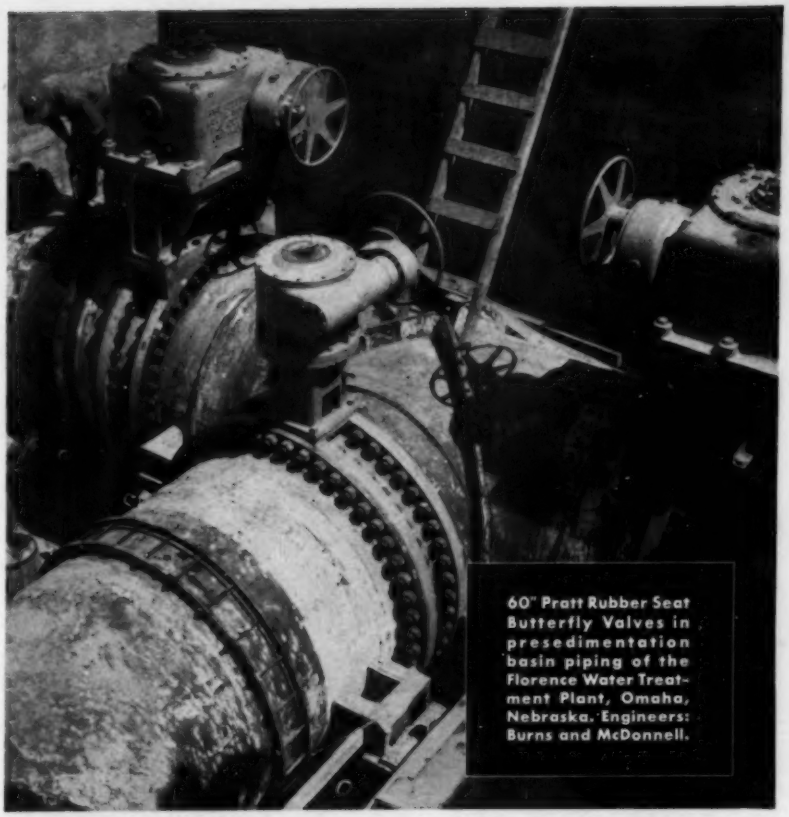
Joseph M. Duncan, a sales representative in the New Orleans district since 1951, succeeds O'Riordan as manager at Atlanta.

O. V. Tally, director of industrial sales, has been appointed manager of the firm's Washington district. In his new capacity, Tally will be in charge of all Washington operations for the company's Industries and Tractor groups.

"He Won't Either!"

Customer: Well, your explanation may be all right, but I can't drink this water—it's awful. Call your Superintendent.

Inspector: It's no use madam: he won't drink it either.



60" Pratt Rubber Seat Butterfly Valves in presedimentation basin piping of the Florence Water Treatment Plant, Omaha, Nebraska. Engineers: Burns and McDonnell.

OMAHA... Butterfly Valves are key to compact piping

This ultra-compact arrangement of three 60 inch valves could only be made with Butterfly Valves. The illustration shows the narrow face-to-face dimensions (only 15") and the compactness of the valve-operator assemblies. What you can't see is equally important! The rugged internal construction—the rubber seat that is never under severe pressure from the valve disc, only partially displaced during closure... features that mean years of easy operation without maintenance problems or costs.

Pratt originated the Rubber Seat Butterfly Valve and has installed more of them than any other manufacturer.

For valve design with a 50 year reputation for practical imagination, see Henry Pratt.

NEW! Latest, most accurate pressure drop and flow data, conversion tables, discussion of butterfly valve theory and application plus other technical information.

Write for Manual B-28

HENRY PRATT

RUBBER SEAT Butterfly Valves

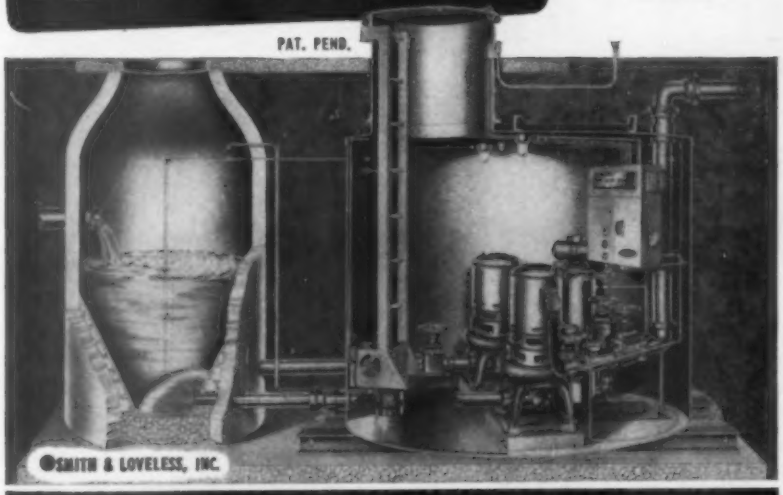
Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

HUNDREDS OF INSTALLATIONS—IN 27 STATES!

Specify—
The Smith & Loveless
FACTORY-BUILT PUMPING STATION

PROVEN QUALITY—WITH FACTORY-BUILT SAVINGS



THE MOST ADVANCED DESIGN IN SEWAGE PUMPING STATIONS

We specialize in building America's finest sewage lift stations. Acceptance proves their quality. Smith & Loveless offer you a complete line of six standard size lift stations with capacities from 20 GPM to 1600 GPM per pump or ejector. Larger capacity stations are built to your order.

- An integrated design, each piece proven by the test of time.
- Precision assembled by factory experts.
- Automatic dehumidifier to eliminate condensation.
- A central electrical control cabinet prewired and color coded.
- Shot blasted steel structure epoxy coated plus cathodic protection.
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W&SW

New Literature

Micro-Straining Bulletin

215

Glenfield & Kennedy, Inc., New Rochelle, N.Y., has just published a bulletin on how **Micro-Straining Solves Algal Problems.**

The bulletin features 4 different installations of micro-strainers: Bristol, England, using seven units to handle 2—m.g.d. flow; Colne Valley Water Company, Middlesex, England; Auckland, New Zealand; and the Ashford Common Works, London, England. The bulletin details construction of the fourth installation of micro-strainer units for the Metropolitan Water Board of London. Photographs of each installation are included.

New Solvay Products Book

216

Solvay Process Division, Allied Chemical & Dye Corporation, New York, N.Y., has published a comprehensive new book containing detailed information on the entire line of Solvay alkalies and chemicals.

This **Products Book,** as it is called, includes informative data on the uses, markets, physical and chemical properties, packaging and handling and storage of the Solvay line. Also included is a listing which groups the products by consuming industries or manufacturing processes. The book is illustrated with photos of buildings and manufacturing operations at the various Solvay plants.

Antifoam Information Sheet

217

Hodag Chemical Corporation, Chicago Illinois, has just published a factual information sheet describing the properties and applications for **Hodag Antifoam S-88.**

According to the information sheet, Hodag Antifoam S-88 is designed to efficiently prevent the formation of foam in activated sludge waste treatment plants of industrial companies and municipalities. Liquid S-88 is applied manually or automatically to the aeration tanks. Usages of 0.5 to 1.0 parts per million are average for normal foaming conditions.

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Continuous Volumetric Feeding of Liquids and Slurries

218

Omega Machine Co., Providence, R.I., has just published a bulletin on the **Rotodip, Continuous Volumetric Feeder For Liquids.**

The 4-page 2-color bulletin describes the many advantages which simplified design and durable construction can bring to the continuous volumetric feeding of liquids and slurries.

The feeder is designed around a rotary dipper wheel. Its accurate operation, its versatility, its adaptability to automation, and its many other features are described in this new bulletin. The bulletin also contains several halftone illustrations, a line drawing of a typical process installation, and dimensional drawings.

Acid Handling Pump

219

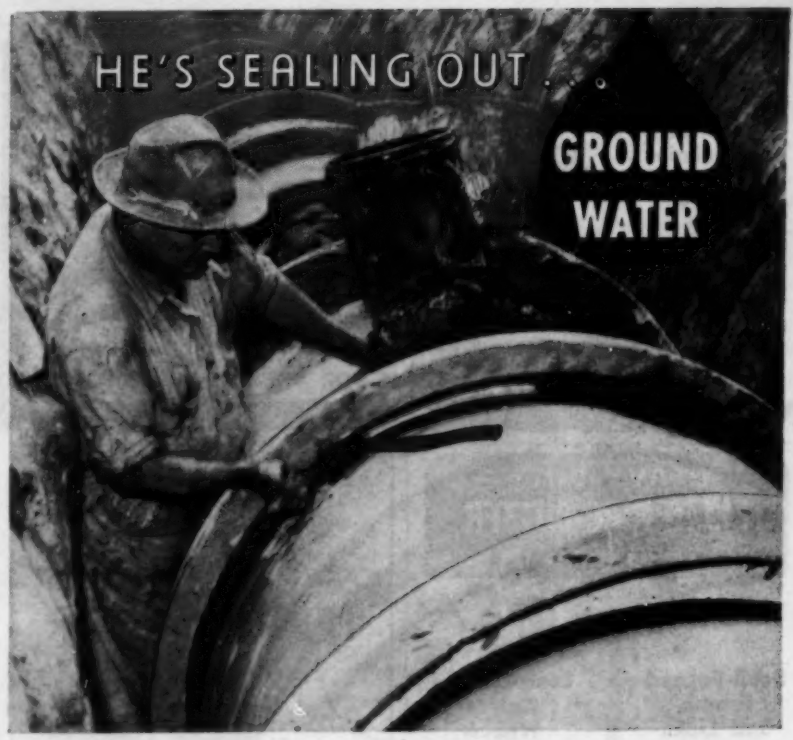
Dorr-Oliver Incorporated, Stamford, Conn., has just published a 2-color, 6-page bulletin on the **Olivite Acid Handling Pump.**

The bulletin describes the design features, corrosion-resistant materials of construction, applications, sizes and capacities of the pump. In addition, it contains equipment photographs, cross-sectional wash drawings of the unit and performance and power requirements.

Thermal Conductivity Analyzers

220

Arnold O. Beckman, Inc., South Pasadena, Calif., has published a 16-page booklet on the practical application and operation of **Thermal Conductivity Analyzers.** Complete with photographs, drawings, and diagrams, the booklet offers valuable information to those interested in continuous gas analysis instruments.



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Chlorine Gas Feeders

221

Builders-Providence, Inc., Providence, R. I., has just published a bulletin on Builders-Providence Models CVS and DVS **Chlorinizers.**

The bulletin diagrams four types of control: Semi-Automatic, Step, Program, and Automatic Proportional Control. Construction features, operation and application advantages, safety features, dimensions and control variations are discussed, giving a complete product picture. Illustrated are the visible flow indicator, visible vacuum pyrex bell jar and positive-control chlorine diaphragm valve.

Smith-Blair Products For Asbestos-Cement Pipe

222

Smith-Blair, Inc., South San Francisco, Calif., has available a bulletin on **Smith-Blair Products Designed Especially For Asbestos-Cement Pipe.**

This attractive 2-color, 16-page bulletin illustrates and discusses the company's line of: Full-Circle clamp couplings; Repair service clamps; Taper-Seal service clamps; Simplex and Ring-Tite flanged adapter; Flexible flanged coupling adapter; Collar leak clamp; Plain-End tee; Flexible couplings; and Blind-End couplings.

Totally-Enclosed, Fan-Cooled Motors

223

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a bulletin discussing the latest design features of **A-C Totally-enclosed Fan-cooled Motors** in NEMA rerated ratings of ½ to 100 hp.

According to the bulletin, the new features of the rerated motors include a diagonally split cast iron conduit box for increased accessibility and ease of wiring leads with attached metal markers and positioned by number for ease in making connections, and a rotating shaft seal on the shaft extension end of a material impervious to corrosive agents.

In addition to cutaway views of the motor, the bulletin includes tables of ratings and dimensions as well as a horsepower frame chart.

2-Pole Squirrel-Cage Induction Motors

224

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a bulletin describing **Allis-Chalmers Large Two-Pole Squirrel-Cage Induction Motors.**

Construction details typical of the motor given in the bulletin include a description of its spiral ventilation system which has proved successful in large steam turbine generators, and of measures taken to achieve quiet operation in these high speed machines.

Supplex Flexible Pipe

225

Supplex Co., Division of American Hard Rubber Co., New York, N. Y., has just issued an 8-page bulletin describing **Supplex Flexible Polyethylene Plastic Pipe** and fittings.

Contents of the bulletin include: Applications for Supplex pipe, sizes of standard pipe and fittings, installation instructions, technical properties, and estimated flow rates for water in various pipe sizes. Of particular interest to the industrial buyer is a chart which lists many common industrial liquids and specifies which of these liquids may be carried in Supplex piping.

Index of Instrumentation Literature

226

Minneapolis-Honeywell Regulator Company, Philadelphia, Pa., has just published a bulletin covering their **Index of Instrumentation Literature.**

The bulletin covers catalogues, bulletins, specification sheets, data sheet, illustrated lectures and articles from Instrumentation Magazine.

Protective Coating Guide

227

Koppers Company, Inc., Pittsburgh, Pa., has just published a **Bitumastic Protective Coating Guide** for the prevention of corrosion in sewage and waste treatment plants.

Amply illustrated, the guide discusses where corrosion can cause severe damage in the plant and the many corrosion resistivities of the Bitumastic coatings. Specification information for the coatings in regards to concrete structures, concrete pipe, steel and ferrous metal surfaces, and non-ferrous metal sufaces are given.

The two center pages contain condensed specifications for the 6 different types of Bitumastic coatings. Three pages are devoted to a listing of different equipment and structures and the recommended Bitumastic coating for each. Equipment listings range from air blowers to weirs, steel. Actual installation photographs are also included along with a short case history of each installation.

Vertical Pressure Filters

228

Cochrane Corp., Philadelphia, Pa., just published two folders on **Cochrane Vertical Pressure Filters.**

The folders describe types "A" and "B" filters. The difference between the two types lies primarily in the underdrain system of each.

Both folders cover complete operating details, filter bed materials, design features, available accessories, etc., as well as drawings that show various arrangements of two, three and four header units.

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Plastic Pipe, Fittings & Valves

229

Colonial Plastics Mfg. Co., Cleveland, Ohio, has released a 16-page engineering catalog giving complete data about the **Van-Cor Unplasticized Polyvinyl Chloride Pipe, Fittings and Valves.**

The catalog covers both types of Van-Cor: chemically-resistant, normal-impact Van Cor 1 and chemically-resistant, high-impact Van-Cor 2.

Contents include physical properties, chemical resistance tables, pipe, fittings and valve dimensions and flow rate charts, as well as useful pipe assembly and installation data.

Installation Techniques For Pipe Tape

230

Minnesota Mining & Manufacturing Co., St. Paul, Minn., has just published a new how-to-do-it booklet describing various techniques for protecting underground pipe from corrosion with "Scotchrap" brand pipe insulation tape.

Called **"Tape It Easy"**, the new 24-page booklet provides step-by-step photographs and instructions for wrapping bends, elbows and short sections, patching pipe with tape, preparing joint surfaces for wrapping, wrapping welded joints and taping straight pipe sections as well as "T" fixtures and other typical fittings.

A coverage table on the book's back cover lists recommended tape width for various pipe sizes, outlining the minimum recommended tape overlap and the number of squares of tape needed per 100-feet of pipe using various overlaps.

Solids-Contact Reactors

231

Cochrane Corporation, Philadelphia, Pa., has just released a 24-page bulletin on **Solids-Contact Reactors.**

Supplementing a cut-away photograph are several pages of plan and elevation drawings showing a wide variety of designs that are available.

The bulletin discusses theory and the problems of cold water clarification, as well as advantages and applications of various different designs. Also included is a section on auxiliary and supplemental apparatus.

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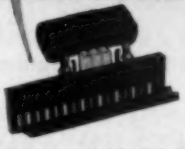

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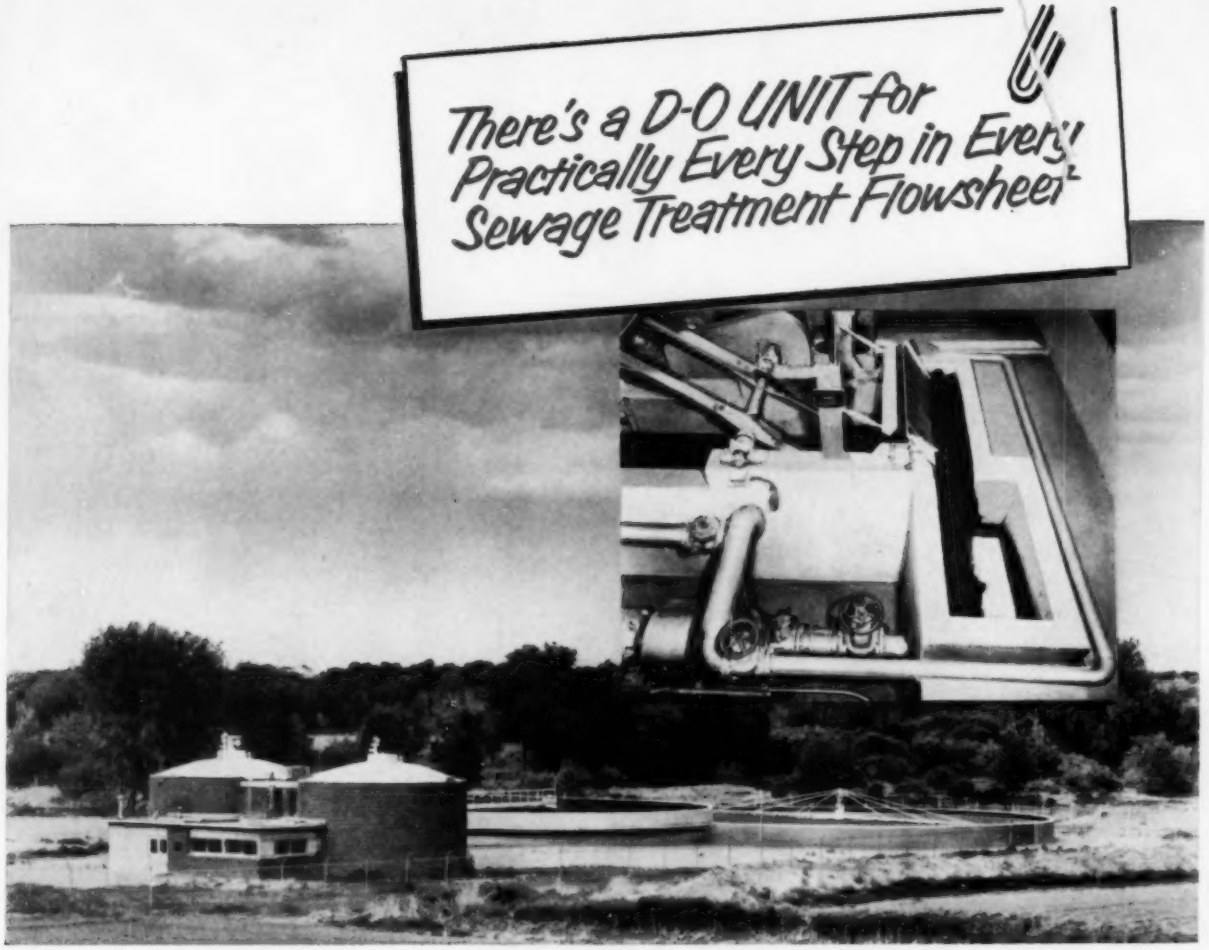

General view of the plant. Inset, closeup of Bar Screen and Disintegrator.
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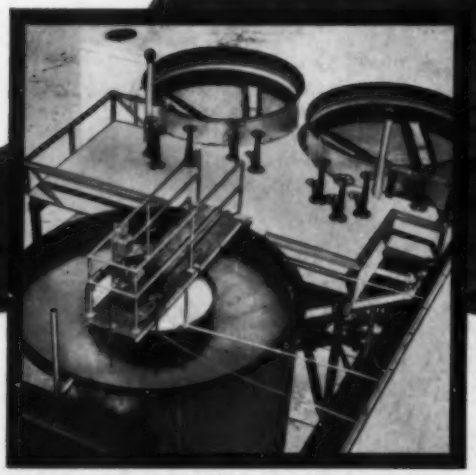

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